COVER BY RALPH BUTLER

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Item migration and the dynamics of inventory management

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Research conducted at the Defense Electronics Supply Center indicates that DoD needs to radically rethink its management of inventory systems.

When setting stockage policy, doing inventory analyses, or making budgeting decisions, supply managers usually assume that characteristics and demand within categories of items will remain reasonably stable. In keeping with that assumption, they base their actions on periodic "snapshots" of item data at given points in time. An evaluation of eight years of historical data from a major defense supply center, however, strongly suggests that the traditional approach to inventory management in the Department of Defense is wrong.

Specifically, analysis indicates that failure to consider the dynamics of DoD's large and complex inventory systems usually results in policies that treat symptoms rather than the problems officials had sought to remedy. A fixed-buy approach on items which are turning over rapidly within a management category is just not realistic. In fact, decisions based on static snapshots in time are actually harmful to customer support and wasteful of stock funds.

Inventory management today

Inventory control systems such as the one discussed here involve large-scale movement of items between management categories—referred to as item migration—and require a change in purchasing and management policies. New guidelines must take into account the time an item remains in a category and

Inventory managers now collect data at a fixed point in time and evaluate them against selected measures of effectiveness such as back orders on hand, requisitions on back order, stock availability, dollars committed to lead-time and on-hand inventory, excess stock, and so on. These data are integral to applications at every level of management, and auditing agencies such as the Defense Audit Service and the General Accounting Office use them to evaluate the overall effectiveness and efficiency of inventory policies and management decisions. In addition, budgets are approved and stock fund monies allocated based largely upon these data.

Normally, reports group data by management categories that consider, among other things, the number of times customers order an item (demand frequency or requisitions) and the dollar value of a forecasted year's demand. Data within a category are in aggregate form; individual items that comprise that category are not identified. When presented in this manner, data in the various categories appear to have a great deal of stability in both composition and characteristics. Therefore, in most inventory systems, the implicit assumption is that items remain in a management category indefinitely.

This assumption carries forward into system evaluation and allocation of stock fund monies, and the consequences are not always happy:

The perils of ignoring item migration

An August 9, 1976, General Accounting Office report illustrates some of the potentially harmful effects of assuming inventory stability. In that report, entitled *Greater Use of Commercial Distribution Systems for Minor, Low-Use Supply Items Can Reduce Defense Logistics Costs* (LCD-76-422), the auditors cited inefficiencies in buying and stockage policies at the Defense Supply Agency (now the Defense Logistics Agency). They noted that, in a given year, demand for each of approximately 600,000 items had amounted to $400 or less, while the agency had received no requisitions at all on another 524,500 stocked items.

The analysts conducting the study used snapshot data, which showed a relatively stable number of items in each item management category and very large assets—ten times more than the amount normally requisitioned—for certain low-demand items. They concluded that poor buying and stockage policies were resulting in overbuys and that, in the interest of cost-effectiveness, the agency should not stock items issued less than four times a year. Instead, customers should purchase them directly from local, commercial sources.

But given the dynamics of the inventory system studied, both conclusions, as applied to *all* low-demand items, were questionable. Had the Defense Supply Agency stopped stocking all items not requisitioned during a one-year period and disposed of those assets, now demand in the following year would have resulted in a minimum of 90,000 purchase requests for the items no longer stocked. At a rate of 900 purchase orders per year per buyer, the agency would have had to hire 100 new buyers to handle the workload.

been purchased under stockage policies in another, entirely separate management category.

- Similarly, a decision to stop stocking thousands of items in a category can prove ill-advised if it does not take into account the items' history; though the category overall may have experienced little or no demand, not all items in it will have had the same demand history.

Probing the issues

Preliminary research into inventory management issues got under way in the wake of a General Accounting Office report which recommended that defense supply managers rely more heavily on commercial sources for low-demand items (see sidebar). Responding to this recommendation, analysts at the Defense Logistics Agency developed a model to determine which items, based on cost, should be converted to nonstocked status. For items at the Defense Electronics Supply Center, results indicated that more than 80 percent of low-demand items belonged in the nonstocked category; in other words, center personnel would have to purchase those items whenever a customer requisitioned one. Because the average lead time for ordering and receiving stock at the Defense Electronics Supply Center is about eight months, reclassification could have had a major negative impact on military readiness.

In setting up the model, analysts had pegged annual costs for holding stock of low-demand items at 186 percent of the price of the center had purchased these assets when demand for the items was high and when they were in different categories. Demand later decreased, triggering reclassification of both the items and their assets into a lower management category, which therefore built large assets over time, as is still happening. But only about half the low-value items actually have excess assets; of the half that does not, some are and will remain truly low value, while many others will eventually migrate into higher demand categories. Our early research on item migration convinced the Defense Audit Service that the 186 percent figure was wrong, and the auditors recommended changes to the holding costs for the model.

Most of the underlying principles and assumptions used in the model and in the GAO report still guide inventory management within the Defense Department. At fault are the methods of evaluation applied to supply systems. They have given rise to erroneous conclusions that in turn become the basis for policies applied across the board to categories of items. Sorting out the problem is not easy, as will be apparent from the discussion that follows. This is especially true in a system such as that at the Defense Electronics Supply Center, which manages 900,000 electronics-related items and serves more than 22,000 customers.

In 1980, following the preliminary migration studies described above, the center launched an investigation to determine what was really happening within its supply system. One purpose of this work was to lay a foundation for further policy decisions still

had saved very extensive amounts of item data on computer tapes. We studied the total population of items, not just samples, and tracked each item through its total history. The results show an extremely dynamic system and underscore the need to rethink the way we look at and use data to budget for, evaluate, and manage DoD inventory stocks.

Item migration

The Defense Electronics Supply Center categorizes items as either stocked or nonstocked; it further breaks down the former into replenishment items and numeric stockage objective items. It stocks replenishment items on the basis of procurement cycle quantities and assigns them variable safety levels that take into account constraints on total system back orders. Numeric stockage objective items are not demand-based, and the center stocks them in accord with fixed rules based on type of item, item assets, cost, and expected demand. They either have no demand history, or demand has dropped below a fixed level; if and when demand matches certain criteria, such items move into the replenishment category. The center also classifies replenishment items by the demand value codes shown in Figure 1. Because these codes and the numeric stockage objective category are descriptive of demand value changes, we were able to use them to determine the extent of item migration and its impacts.

The chart in Figure 2 displays total migration by demand value codes and numeric stockage objective category. Items migrate on a quarterly basis; therefore a period represents a quarter of a year. The "Add" category gives the number of all nonstocked or new items that came into the various categories. Items under the "Out" heading are those which left the various categories. These data include every possible migration, and thus the chart accurately depicts the magnitude of movement overall.

Replenishment category	Quarterly demand
High value 2	$15,000 or more
High value 1	$4,500 - $14,999
Medium value	$400 - $4,499
Low value	$399 or less

What causes an item to migrate? A random sample of items that changed categories between March 1980 and March 1981 established that demand or a combination of demand and price changes were the major factor in 95.6 percent of the migrations. Changes in price only and file errors accounted for 3.4 and 1.0 percent of the migrations, respectively. An April 1983 status check of this migration sample showed that 71 percent of the items that had moved from the high-value to the low-value category stayed there, became nonstocked, or were no longer managed by the center; 29 percent migrated back up—13 percent to

Figure 2. Total item migration, March 1976 to March 1980*

TO / FROM	High value 2	High value 1	Medium value	Low value	Numeric stockage objective	Out	Total migration from category
High value 2		8,146	664	58	152	503	*9,521*
High value 1	[illegible]		26,444	716	1,136	991	*37,309*
Medium value	1,281			106,641	21,446	5,312	*160,679*
Low value	159	1,172	93,425		170,838	22,765	*288,359*
Numeric stockage objective	658	2,900	34,786	117,262		247,213	*392,819*
Add	1,090	2,700	16,882	40,097	182,230		*242,999*
Total migration							

(49,916 items)

Replenishment category	FROM	TO
High values 1 and 2	6,776	6,792
Low value	23,356	26,660
Numeric stockage objective	8,696	5,388
Non-stocked and non-preferred	4,220*	1,328**
Total	43,048	40,168

*Includes new items
**Includes items no longer managed by the Defense Electronics Supply Center

the high-value categories and 16 percent to the medium-value category. Among items that had shifted from low to high value, 40 percent retained that designation, 28 percent migrated back to the medium-value category, and 32 percent returned to low-value status.

A detailed look at migrations in one category for each year helps illustrate the true extent of migration and its impact on management decisions that consider only snapshot data from a system. Figure 3 depicts demand patterns and migrations for medium-value replenishment items from March 1980 to March 1981. While the total population grew by only 4,481 items, total migrations numbered 83,216. In other words, while the number of items within the system appears constant at any given time, we assume wrongly that this population comprises mostly the same items. Total migrations, which include all changes in demand value codes every quarter or every other quarter, exceed

would be a policy which is flexible and adaptable, depending upon the length of time an item spends in a given category as well as the category it is in. Analysis of a category of items can easily lead to the wrong conclusions if it ignores the effects of migration.

Data on numeric stockage objective items show the dynamics of migration even more dramatically. For the period from March 1976 to March 1980, any snapshot of that data would have indicated a population of about 340,000 items; yearly demand and stock on hand would also have appeared stable. But during these four years, 375,922 items moved into this seemingly constant population and 392,819 items moved out. Such activity underscores the potential for error in reaching conclusions based upon assumptions of population stability.

Numeric stockage objective items are in the low-value category, and many of them stay there for several years. Not all, however, are truly low value. The population includes new provisioning and other items entering the system (see Figure 2) as well as older items migrating down from replenishment status, the latter may increase again in demand or be reclassified nonstocked and their assets sent to disposal centers. Moreover, a preponderance of all purchase orders for stocked items at the Defense Electronics Supply Center are for low-value items; therefore, given the magnitude of migrations in this population, buyers are not buying the same items each year. While the full impact on purchasing is not known yet, administrative lead time is definitely affected.

As noted above, in a review of the supply system at the Defense Logistics Agency, the General Accounting Office identified 525,000 stocked items which had zero demand and recommended that officials designate them for purchase from commercial sources. Our analysis of data on zero-demand items from the Defense Electronics Supply Center, however, suggests a different course of action. The data in Figure 4 represent four years of subsequent requisition distributions on 228,054 numeric stockage objective items which had had zero requisitions from March 1975 through March 1976. Every year the number of items for which demand was higher increased, and due to migration, the items in

Figure 4. Subsequent requisitions for 228,054 numeric stockage objective items which had zero requisitions from March 1975 to March 1976

Year	Number of Requisitions														
	0	1	2	3	4	5	6	7	8	9	10	11-15	16-20	21-50	more than 50
1976-77	166,823	30,641	10,179	4,124	2,026	1,095	638	357	237	145	84	183	61	75	20

additional purchase requests—more than 90,000 per annum—and supply support would definitely have suffered.

The data displayed in Figure 4 are also available for all nonstocked numeric stockage objective and replenishment items for which the center had three or fewer requisitions between March 1975 and March 1976, and these data show the same overall effect. Granted, determining which items customers will

ies Supply Center's item history tape for June 1979 and then tracked items that had excess assets back to March 1976 (see Figure 6, p. 8). The data for this population show that the low-value category gained the approximately 7,000 items lost by the medium- and high-value categories; excess dollars in the low-value category almost doubled. Unaware of migration and its magnitude, and relying instead on snapshot samplings of this

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requisition more frequently and which ones they will order less frequently or not at all is a problem we have not yet solved. First we need to improve forecasting methods for the kind of dynamic inventory system typically found at defense supply centers.

Item stability amidst turmoil

Although the inventory system at the Defense Electronics Supply Center is quite dynamic, some stability does exist. Of 45,435 items coded medium value, 27,000 remained so after one year, and about one-third of the original number were still medium value after two years (see Figure 5). The average actual lead time for medium-value items is about 202 days. Thus a large percentage of them have already migrated out of the category when stock ordered arrives on the shelf, and most of the migration is to lower-demand values, as Figure 5 indicates.

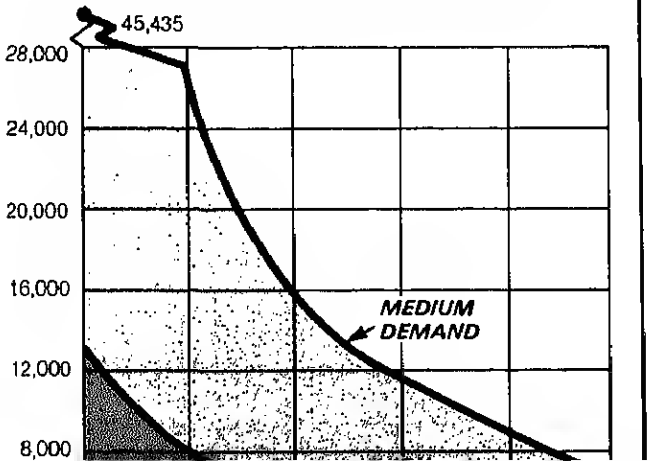
Among high-value items, about 40 percent had migrated after the first year. Average lead time for such items is about 250 days. If demand justifies designating an item high value for three years, the item will very probably remain in that category for an extended period of time. Such items should be good candidates for larger procurement cycle quantities, which usually allow center personnel to negotiate breaks and also result in fewer purchase requests and back orders. In fact, among items in any category—high, medium, or low value—for three years or more, the number migrating out decreases significantly.

Some impacts of item migration

data, one could easily conclude that inventory managers were overbuying low-value items. And in fact, DoD cut budget authorizations for the numeric stockage objective category because on-hand assets were excessive and officials wanted to reduce stock being purchased in this category.

But in reality, the data indicated that the center had been un-

Figure 5. Number of items remaining in the categories of high- and medium-demand value, March 1976 to March 1981



the axe on the wrong category. The center purchased assets on the items when they were in higher categories and being managed under different policies.

Migration and back orders. As remarked above, items generally migrate downward, and their excess assets migrate with them. Items that move to a higher demand category carry few or no assets, but they do bring along a growing number of back orders. This phenomenon is not new or unique but is worth noting. Just as data on assets can be misinterpreted, so too can back-order data be misleading and result in inefficient policies or misapplied resources.

Figure 7 displays back-order data for items in the medium-value demand category as of March 1981. Of the 20,852 items that had been medium value for less than one year, the center had back orders for 3,712, or about 18 percent; that figure represented 26.8 percent of the total requisition volume for those items. Among 7,698 items in the medium-value category for five or more years, back orders on-hand numbered 554, or 7.2 percent; back orders accounted for just 10 percent of the requisition volume for such items. Statistics for these two groups illustrate the impact of migration on back orders. Unfilled orders accumulate on items migrating up and accompany them. But the longer formly for all items in a category. Frequently, for example, they decide to buy larger quantities. Yet as the data in Figure 7 demonstrate, the majority of medium-value back orders are on items that have recently migrated into the category, most of which are moving up from lower-demand categories. If logisticians are ever to address the back-order problem effectively and economically, they must find ways to identify those items most likely to move up and then increase supply levels before the stock migrates.

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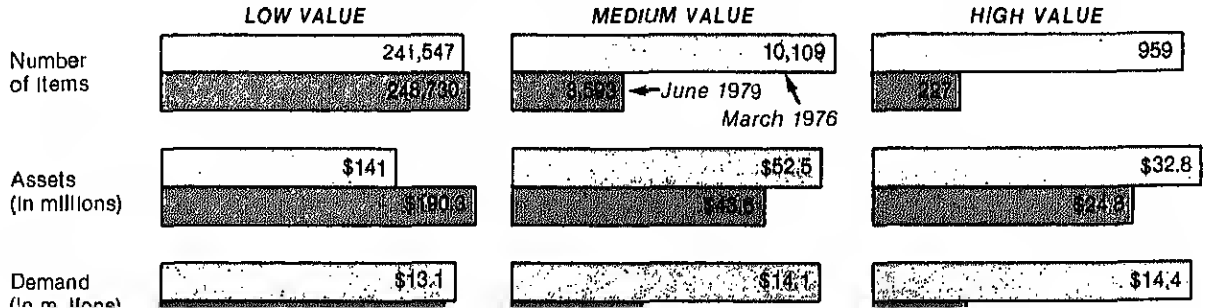
Analysis of several years of historical data can yield strong evidence of items most likely to migrate upward, as researchers at the Defense Electronics Supply Center discovered. They evaluated five years of numeric stockage objective data for weapon system items in the inventory there. If such an item receives just one requisition, they found, demand for that item will increase significantly within a year; inventory managers should therefore purchase additional stock immediately.

Migration and frequency. While back orders are markedly lower for items that have been medium-value for five years or more, the frequency of demand per item back ordered in that category quadruples (see Figure 7). In other words, the longer an item is stable in a demand category, the higher the frequency of demand. This finding supports the need for flexibility in buying

Figure 6. Asset migration of replenishment and numeric stockage objective items managed from March 1976 to June 1979

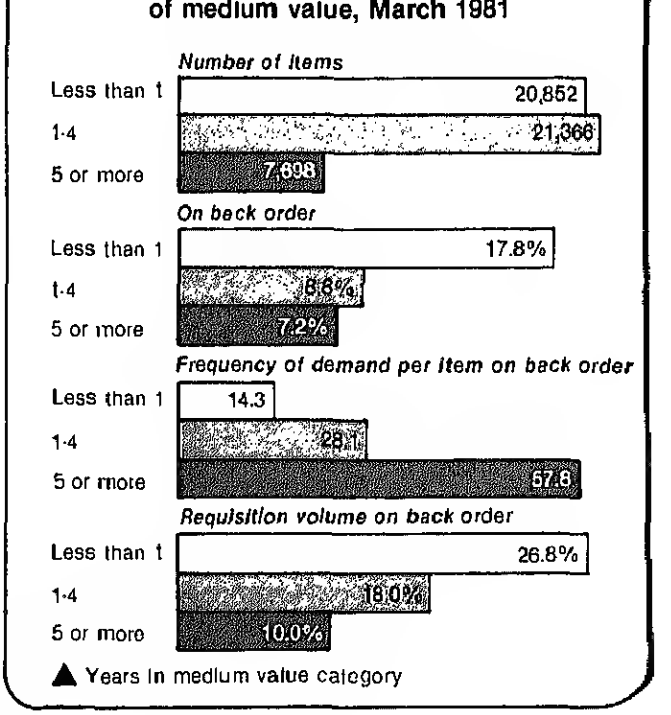


curement cycle quantities for items that have extended periods of stable demand; that approach would offer the advantage of attendant reductions in purchase requests, price, and back orders. However, reduced safety levels for such items could offset these benefits. Management would have to weigh the pros and cons for each case.

Trends in back-order data for high-value items parallel those for medium-value items. But frequency of demand per item back ordered is more than seven times greater for items which have been high value for five years or more than it is for those which have been high value for one year or less. As discussed earlier, only a few of the 5,427 new high-value items remain in that category for more than a year. Those which do clearly build enormous demand over the years. The challenge is to identify items migrating up which will remain high in demand. Data from customers, high priority requisitions, essentiality coding, item characteristics, and historical demand patterns can all be helpful. As in the case of medium-value stock, inventory managers may want to treat stable high-value items differently from those which are high value for a very short time.

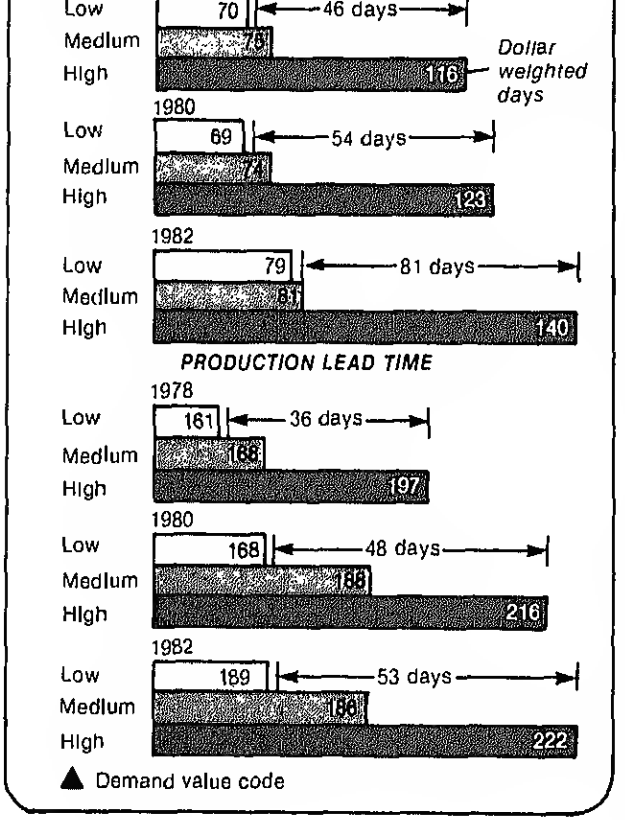
Migration and lead times. Lead time is the time it takes to order, produce, and ship an item, and migration also affects supply management by virtue of its impact on lead-time values. Those values change as a function of demand value category. Specifically, the dollar value of the lead time for a category, divided by the average demand value in dollars per day for that category, yields dollar-weighted days, which are the measure of lead-time value. As the data in Figure 8 (p. 10) indicate, the value of dollar-weighted days can vary greatly depending upon demand value category. As an item migrates upward, it typically puts pressure on the stock fund budget because lead time, which must be paid for, is increasing. But budgets, when initially prepared, do not normally take such migration and its associated costs into account. This oversight can be expensive and result in unexpected commitments of funds, as the data in Figure 8 readily illustrate. On average, for example, when items migrate directly from low-value to high-value categories, funding can be 114 dollar-weighted days too low due to changes in both administrative and production lead times.

The timeliness of support also suffers when an item migrates from the low-value to the high-value category. The data in Figure 9 (p. 11) show the magnitude of degradation in actual lead-time days for selected federal stock classes. As an item migrates, not only do lead times increase but the requirements system also lags behind the quarterly forecasted demand, which is used in determining stock levels. Related problems include increased purchase requests, poor stock availability, additional back orders, and unreasonable required delivery dates for procurement planning pur-



all the problems uncovered. But it has profoundly altered our understanding of the workings of inventory systems, a necessary first step toward making supply management in DoD more efficient and effective. We now know that such systems are dynamic, not static, and that inventory managers should therefore no longer take action based on snapshots of a system at fixed points in time. Decisions that assume stability are likely to prove ill-advised.

In looking at back orders in a category, for example, a manager might easily assume that they are a consequence of buying policies in the category to which the item migrated and might respond by implementing new policies across the board on all items in that category. But in fact managers should build stock levels in lower demand categories only on those items which past performance has shown are likely to increase in demand. When such items migrate, they carry their back orders with them. *Selectively increasing levels within the total spectrum of demand* categories is more cost-effective and hedges against uncertainty of demand and lead time. By critically examining system characteristics such as migration patterns and magnitudes, management can better evaluate inventory system performance and formulate more effective and efficient stockage policies.



evaluating historical data, inventory control points can identify these items and tailor policies to specific needs. Results from detailed simulations using representative demand data illustrate the value of such an approach: on items likely to increase in demand, small investments in safety levels provide the same stock availability as do larger buy quantities, but at 75 percent less cost.

impose a one-year minimum across-the-board on buys of medium-value items. In light of this finding, DoD needs to seriously reexamine its recent decision to place a one-year minimum on procurement cycle periods for all high-value annual demand items.

Buying and managing items as a function of the time they remain at a given demand level would be more reasonable. As is clear from Figure 5, the risk of a significant demand decrease is much lower on stable high-value items than on those for which demand has been high for a short period. A prudent buying policy in a large, dynamic system would take into account the magnitude of potential migration due to demand changes, limit procurement cycle quantities on items migrating, and allow larger procurement cycle quantities on stable items; it would also bolster stock levels on items likely to experience demand growth.

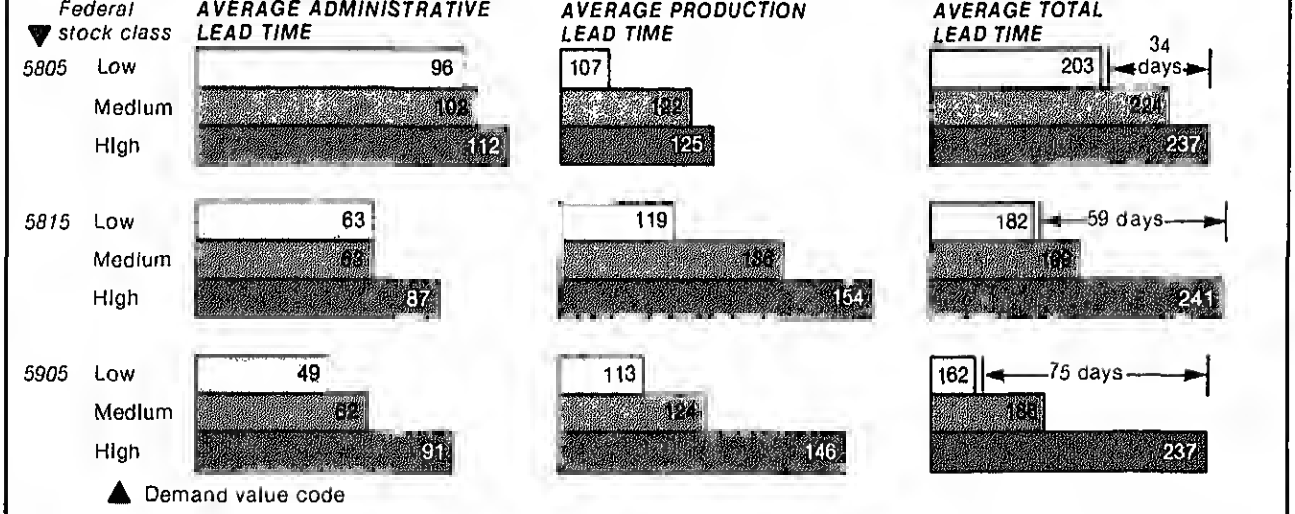
In addition to wide swings in demand, migration produces wide variations in procurement lead time, which also tend to degrade system performance and customer support. Not only do lead times vary within a given demand value category, but high demand value items have significantly longer lead times than do low demand value items, as the data presented in Figure 9 make clear. In part, the difference derives from the procedures and procurement regulations that apply to higher dollar buys. When migration is heavy, management needs to be aware of this difference and respond accordingly.

Once an item migrates upward, the lead time necessary to build stock levels and determine size of buys will reflect the increased forecasted demand. But the lead times experienced in the old or lower-demand category form the basis for building these levels, and as a result, back orders increase and stock availability decreases beyond what was expected. By advancing lead times on items migrating, DoD could eliminate some back orders and increase customer support. But this measure would require a change in policy to permit earlier stock fund expenditures than are now possible.

If the Defense Electronics Supply Center had decided, on the basis of fiscal year 1976 data, to stop stocking all zero-demand items, that action would have generated a surge in additional purchase requests—more than 90,000 per annum—and supply support would definitely have suffered.

Moreover, increasing buys on all high-value or high-demand

An item buy or management policy is ineffective without the



stockage objective item buys, and so forth. Good evaluation schemes, sensitive to the dynamics of the inventory system, would make the budget process even more efficient. For example, if analysts had examined the system dynamics at the Defense Supply Agency before GAO did its study, they would have been able to identify those categories and policies that were generating excess assets, and auditors would not have recommended a cut in funds for low-value or numeric stockage objective buys. Moreover, a clear understanding of migration would provide strong support for the additional funds needed to build stock levels on items with very high probability of increased demand such as weapon system items.

Reforming the system

High migration is characteristic of some inventory systems, such as that at the Defense Electronics Supply Center, and it requires changes in the way DoD does business. Officials need to tailor buy and management policies to individual items, by class and within demand value categories, as a function of the length of time an item remains in a category. However, only additional research will enable us to predict migration more accurately. Because of the magnitude of migration, the policy of a uniform buy across a given demand value category makes it almost impossible to evaluate system performance. Even so, on items for which demand is likely to be stable, supply centers can use techniques such as quantity discount buying, in conjunction with holding rates that have a low obsolescence factor, rather than adhere to a obsolescence factor can be useful. Forecasting lead times on items that are migrating and adjusting supply levels accordingly as soon as possible can also enhance supply management.

Though the broad outlines of the problem are beginning to emerge, research on migration issues is not yet complete. Results to date do suggest that migration is universal in DoD among unrepairable spare parts. In December 1985, for example, a researcher at the Air Force Institute of Technology, working with staffers at the Air Force Logistics Command, completed a study of three years of historical data at the command and found that migration intensity at all the air logistics centers was the same as that discovered at the Defense Electronics Supply Center. If we are to attain adequate customer support at a reasonable cost, we have no choice but to establish logistics policies and systems to deal with migration and its effects. DMJ

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Raising the quality standard in defense manufacturing

By JOHN D. RITTENHOUSE

an defense industries improve product quality and at the same time hold the line on cost? The experience of one major contractor suggests that they can.

merica strives to compete in the international ketplace, quality is more than a competitive —it is a necessity for our nation's economic sur- d nowhere is the need for quality more critical e defense industry, where the stakes are consider- er than profit and loss.

etorical posturing aside, what exactly is quality? e we define it, how do we make the transition ory to practice? Drawing upon defense manufac- perience at the RCA Corporation, this article nswer those questions. It does so, moreover, in c terms that do not skirt the sensitive issues

our nation's freedom and security depend on the American industry to improve quality and lower cognizing the urgency of the need, the Depart- Defense, the military services, and the National cs and Space Administration have a variety of under way to improve quality and productivity. w Quality Excellence Program, which empha- concept of designing and building in quality, a number of them.

hile, major American companies, spurred not by nt action but by competition, primarily from Ja-

efforts may not be enough to bring about the improvement our nation needs in order to remain a world economic power.

When an issue is as important to America's future as quality is, good intentions, sincerity, and even sheer effort will not suffice. In fact, the growing number of quality and productivity programs, initiatives, legislative proposals, regulations, and guidelines may have the net effect of slowing the progress industry is making. They may increase the cost of defense while producing only marginal improvements in quality.

The situation demands something more than earnest effort. The nation needs a long-term, comprehensive, coordinated commitment to quality by government and industry alike. There are no quick fixes to please members of Congress looking for votes, nor are there any quick, bottom-line results to please corporate shareholders. Commitment requires planning, patience, education, and sacrifice; it demands hard work and attention to detail. Above all, it calls for cooperation and teamwork; adversarialism and mistrust have no place. The nation can forge this commitment only if all play by the same rules and speak the same language.

Companies have become very quality-conscious of late

Managing-in quality

Increasingly, American industry recognizes that it must go beyond "inspecting in"—and even beyond "designing and building in"—quality. We must move on to an era of "managing in" quality. That means companies must approach quality improvement as a long-term, continuous management process rather than as a collection of programs that have beginnings, objectives, and ends.

Several tenets are basic to the process so conceived. The first is a definition of the term itself. Is quality some abstract measure of the "goodness" of a product? The number of features it offers? How expensive it is? Actually, we can probably best define quality as "conformance to requirements," as a couple examples will help clarify.

If a small, inexpensive car such as a Ford Escort fully meets all requirements set for it—miles to the gallon, rate of acceleration, highway speed, passenger room, and so forth—then most would agree that it is a quality automobile. But what about a Mercedes? If it meets all requirements—perhaps those for the Escort plus certain luxury features—certainly it too is a quality car. But its quality does not derive from additional amenities or higher price. The Mercedes is a quality car because it meets the demands set for it.

With that as a working definition, what standards of quality should industry aim for? The only standard that really makes any sense today is the ultimate one—perfection. That goal may seem too lofty to many because we routinely accept levels of quality that fall short of perfection. In school, for example, 90 percent is comfortably above average; the teacher gives us an "A" and we think we are pretty good. Unfortunately, in processes involving hundreds, even thousands of subprocesses, that theory springs leaks.

To illustrate, let us consider a process consisting of ten subprocesses; for each, the probability of success is 90 percent. The total process, however, has only a 35-percent probability of defect-free results, an "F" in anybody's book. But if we can increase the probability of success in each subprocess by only 5 percent, the overall probability of success jumps to 60 percent. That is still not great, but it does show that a mere 5-percent improvement in each subprocess can nearly double the overall chances for success. Thus, to meet the re uirement for the total process

At RCA, we call that concept "managing quality in." The management effort includes data collection and the use of techniques such as involvement-in-quality teams and work center meetings, which encourage workers to observe processes and also serve as a forum for considering those observations. Identifying and analyzing sources of nonconformance and evaluating ways to eliminate it are part of the process too. Above all, the concept entails common-sense decision making and action to implement change.

Lately, industry has placed much emphasis on getting the worker involved in quality. That is a worthy and important goal. We must keep in mind, though, that only management has the power to make the resource decisions necessary to fundamentally improve the process.

If we accept "conformance to requirements" as the definition of quality, then logically our goal is to reduce and eventually eliminate nonconformance. To accomplish that end, an industry must determine the amount of nonconformance it is dealing with. It can get that information in a couple ways.

First, management should measure the percentage of defects at each step of the process so that the people involved in that process can take action to correct the problems. Second, since companies are in business to make a profit, they should identify the cost of nonconformance. If a firm can measure what each nonconformance costs in dollars, management can then order its priorities in seeking remedies to the problems. It can use the cost of nonconformance to set goals and monitor progress toward those goals.

Finally, eliminating nonconformance requires an awareness that quality is everyone's job. Every worker in every department is both a supplier who supports some other worker or department and a customer who has requirements that someone else must meet. Nonconformance to standards in any part of a business operation is just as serious and just as costly as it is during the manufacturing phase.

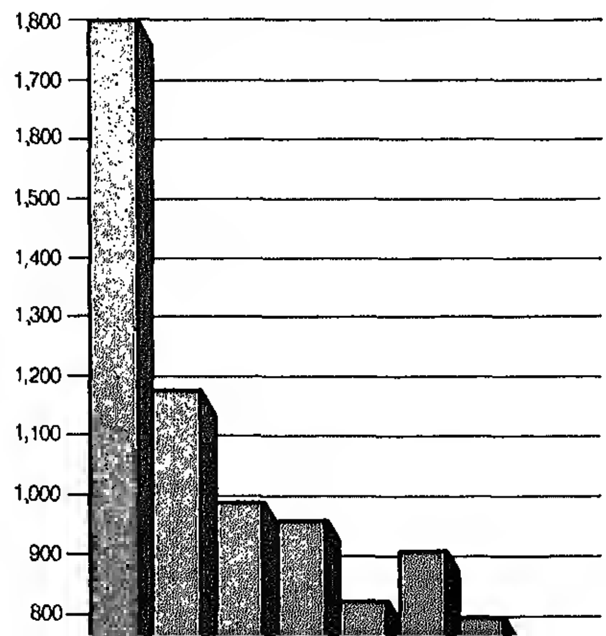
What is the cost of a poorly drawn subcontract that opens a firm up to unwarranted claims, for example? Or the cost of a sales order that is cancelled because it cannot be filled properly? What does it cost to redo a payroll because of e rors 'n put t e comput r? Some co panies

Audit Agency could do with that?

No two companies are alike. Corporate cultures, market conditions, and a host of other factors mandate that each concern, and very often each division within it, develop quality strategies consistent with its own needs and resources. Nonetheless, the basic tenets outlined above are applicable to a wide range of companies and programs. A case in point is RCA's Missile and Surface Radar Division, which achieved outstanding results using sound quality-management techniques.

That division designed and produced the first AEGIS cruiser, the Ticonderoga, which carries aboard her the highly sophisticated AEGIS air defense system. AEGIS is an incredibly complex weapons system that has more than six million parts. The Missile and Surface Radar Division manages a five-year-old quality program, known as AEGIS Excellence, which involves more than half the division's work force in 17 work centers. The customer's program manager provided the impetus for AEGIS Excel-

RCA's success in reducing the number of trouble and failure reports on the Navy's Aegis cruiser



commitment to quality was necessary in order to meet an engineering challenge as formidable as AEGIS. And they recognized that management leadership was the key to making that commitment successful.

The AEGIS success story

The results have been impressive. Central to the success of the AEGIS Excellence program is its measurement, reporting, and feedback system, especially the trouble and failure report. The first Ticonderoga class AEGIS cruiser logged more than 1,800 of these reports. By the eighth one RCA had cut that number to fewer than 800, and we are committed to doing even better (see figure).

On a phase shifter for the system's SPY 1A radar signal processor, RCA cut the number of manhours per unit from more than three to just over one. We also reduced defects per manhour from nearly 0.5 to almost zero. As a result, the cost of producing that unit decreased by about 25 percent.

The SPY 1B processor initially had problems caused by corrosion on copper stripline circuits for its combiner panels. The yield rate was only 48 percent, and the cost of nonconformance was about $395,000 for the 152 panels in a ship set. Work center teams analyzed the process and identified the problem as flux residue from hand soldering of a resistor; they recommended switching to laser soldering with a paste flux. Following testing and implementation of the change, the yield rate shot up to 98 percent, leading to savings of more than $500,000 per ship.

In 1979, the purchased material reject rate for the Missile and Surface Radar Division was more than 9 percent. Under the auspices of AEGIS Excellence, we implemented a very successful supplier reject reduction program. Company officials contacted all suppliers, informing them of the problem and the need for their help in solving it. In addition to conducting supplier awareness seminars in which the Navy participated, we also established a quality hotline and instituted an awards program for outstanding suppliers and counseling sessions for poor ones. By 1984, the reject rate had fallen to less than 4 percent, for savings of about $1.5 million. Through these efforts, we not only reduced costs, but more importantly, we delivered a product that met requirements.

mental quality concepts.

Work-measurement standards

Other well-intended initiatives can undermine efforts to improve quality too. Although opinions on the work-measurement standards delineated in MIL-STD-1567A vary, for the most part such standards seem incompatible with enlightened, quality-conscious management. That certainly is the case with RCA's low- and medium-volume manufacturing.

MIL-STD-1567A focuses on the individual worker, not on the work group as do progressive concepts such as work centers, participative management, automation, cross training, and work sharing. Moreover, measurable "touch" labor, the target of the standards, in most cases should be and is a minor cost factor in modern manufacturing, representing no more than 6 percent of total product cost. If touch labor is greater than 10 percent of costs, even on low-volume defense systems, something other than touch labor needs attention.

In addition, practices such as just-in-time delivery of production material, manufacturing resource planning programs, flexible manufacturing systems, computer-integrated manufacturing, and robotics are making touch labor costs even less significant. Focusing on this minor cost factor may divert our attention from those areas which offer potential for big savings. Work-measurement standards are of particularly dubious value in sectors of the industry such as satellite and large radar system manufacturing, in which low-volume, long-cycle programs predominate and products continually push the technological state of the art. RCA operations can serve to illustrate the point.

The company's picture-tube works in Marion, Indiana, is a high-volume, highly automated operation. Management there uses work-measurement and time standards, though corporate officials do not delude themselves into believing that meeting work standards is a significant factor in competing with Korea and Japan. Process improvement is the name of the game.

On the other hand, at RCA Astro-Electronics in East Windsor, New Jersey, where we build meteorological satellites in very small quantities for the Air Force, work standards make no sense at all. Weather satellites are com-

number of situations, the cost of measuring performance in the exact terms specified by MIL-STD-1567A is higher than the touch-labor cost of manufacturing the product. As a result, in many instances the standard will increase the cost of a product, not reduce it. Furthermore, it will have little or no positive effect on quality.

Real gains lie in improving the process, not in exquisitely detailed measurements of labor content. And the commitment to quality will require major changes in a number of well-established cultures in government, industry, and Congress. In order to bring about change, we will have to educate those cultures.

Specifically, DoD and industry must educate their personnel in the same principles of quality if the two groups are to work together in improving it. To that end, we must develop a comprehensive, long-term training program that spans the government-industry spectrum. It must target real people making real decisions in real situations at every level of organization in the procurement process. It must educate not just the "cultists" in manufacturing and materials but acquisition and process managers, financial people, human relations experts, marketing analysts, secretaries, and executives.

RCA has instituted a curriculum to do just that, starting at the top with three-day, executive-level seminars. The company already has conducted its first training sessions for selected cost-of-nonconformance teams, and many more sessions will follow. Over the next three years or so, some 2,300 RCA managers will attend a five-day course on quality. And next year, the company will begin providing similar training to all its nonmanagement employees, from radar technicians stationed in the field to factory workers and engineers.

Educating government and industry

Recently, DoD's director of industrial productivity, Richard Stinson, proposed what could be a major step toward a far-reaching government-industry educational effort. He asked the Council of Defense and Space Industry Associations to organize a DoD-industry task force; its purpose would be to investigate the feasibility of developing a syllabus on quality for employees in both DoD and industry. The association and its member organizations

The AEGIS air defense system's SPY 1B radar signal processor initially had corrosion problems. After RCA's work center teams recommended a change in the soldering process, the yield rate improved from 48 percent to 98 percent.

as as one of its underlying principles the need for incentives to enhance quality.

In a related area, DoD has established the Industrial Modernization Incentive Program to encourage industry to make capital investments aimed at increasing productivity. A variation on that principle could serve to create incentives for improving quality in existing programs. Why not establish follow-on business options, to be exercised at DoD's discretion, that specifically allow increased profit as a function of reduced cost goals?

Of course, industry would have to produce auditable real costs for monitoring (and if that translates into open books, so be it). The program could include site-specific major capital charges in overhead rates or areas such as areas. Such a program would require that firms identify and accurately measure the cost of nonconformance, either on a company-by-company or program-by-program basis. After determining these costs, management could set goals for reducing them in overhead areas and on the factory floor.

RCA is extremely serious about this proposal, for while the risks may be great, so too are the potential rewards. Moreover, as a company, as an industry, and as a nation, we may not have a choice. Government and industry face the same challenges and must work together to develop a coherent philosophy on quality, a philosophy grounded in a common language, common management principles, common standards, and common goals.

Working together toward a common end is not always easy these days. Perhaps the nation's politicians, media, and general populace believe, at least subconsciously, that our country is so militarily and economically superior that the government and the free-enterprise system can withstand any form of abuse. Perhaps they think that public flagellation of industry is a game we can afford because of our strength or democratic system.

But that is no longer true, if it ever was. American business, labor, and government cannot continue slugging it out in the ring of public opinion if our nation is to solve its problems. We have to stop fighting each other, if for no other reason than that some other governments seem to better understand and be more willing to improve their relationship with labor and industry.

America is poised on a fulcrum point in its economic history. We face worldwide competition on an unprecedented scale, and we are a net debtor nation saddled with the largest deficit in history. Quick and easy solutions to these problems are not at hand, but we can solve them. A commitment to quality will help us all in the quest. DMJ

As executive vice president for aerospace and defense at RCA Corporation, JOHN D. RITTENHOUSE heads five major divisions involved in the design and manufacture of satellites and space systems, government communications and information systems, radar systems, and other advanced electronic products with government and military applications. During his 28 years with RCA, he has had managerial responsibility in a number of major develop-

is coming of age in defense

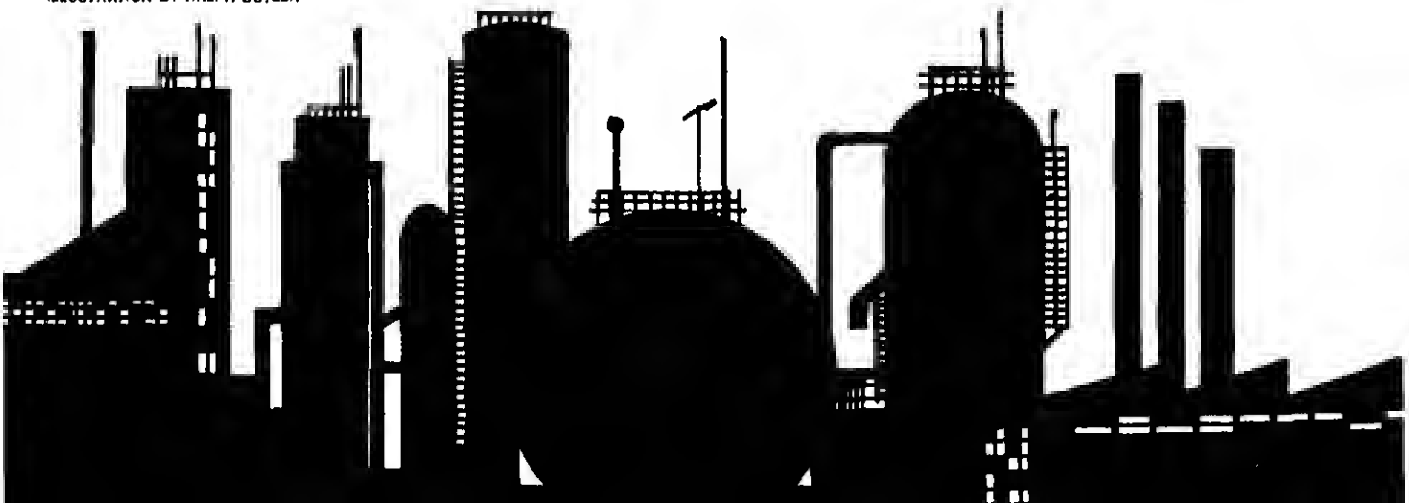
By CARLETON F. KILMER
and
RICHARD J. GOLDEN

Manufacturing resource planning started life as the brainchild of commercial manufacturers; now, defense contractors are adopting it as well in their search for an edge in a fixed-price world.

The current effort to "keep America strong" has had many positive and well-chronicled effects on this nation's defense contractors. Benefits have included the creation of a large number of jobs and overall prosperity within this segment of industry. What is not widely known is that the boom in defense spending has caused contractors to rethink the ways in which they conduct manufacturing and manage their factories. By focusing on factory automation and adopting some of commercial industry's management techniques—in particular, manufacturing resource planning—defense contractors are changing the way they do business internally to lure and secure contracts.

The new approach also responds to changes in the nature of product demand. Defense contractors are now producing weapon systems in higher volumes than at any other period of peace in U.S. history. The low-volume, highly complex strategic weapons of the 1970s are giving way to the higher-volume tactical weapons needed for nonnuclear combat. This shift has caused many of the nation's factories to exceed capacity. Moreover, it has boosted the level of competition. Contractors who win re-

ILLUSTRATION BY RALPH BUTLER



shift, many more companies, including traditionally commercial concerns, are bidding on Defense Department contracts.

DoD in turn is taking advantage of this keener competition by changing many of its contracts from cost-plus to fixed price. This trend amplifies the contractor's need to manage production, for under a fixed-price contract, all unanticipated manufacturing inefficiencies eat directly into profit.

The contractor's dilemma

In the prevailing competitive environment, defense contractors have turned their attention from the product to the process and found that the management techniques and control systems currently in place are out of date. As management evaluates its factories, it is finding many problems, most of which are industrywide; discussion of some of these follows:

- Program versus plant orientation for scheduling and production
- No automated reschedule capability
- High inventory levels and storage requirements
- Build-aheads
- Kits with shorts
- High rates of rework and high obsolescence
- Unrealistic vendor requirements
- Unnecessary expediting and de-expediting
- Inflated lead times
- Antiquated computer systems

High inventory. Inventory overload is a major problem. Although the commercial world has discovered that zero shop orders, an approach that results in upfront delivery of 80 percent to 90 percent of all material needed to satisfy a contract (a notable inefficiency in that some contracts extend for three or more years). Even though the customer, through progress payments, pays most of the high cost of carrying the inventory, the company still has various logistics and management expenses. For example, in addition to large in-plant stockrooms, many companies maintain off-site warehouses reserved primarily for material that will not be used for a year or more. Movement of this material is time-consuming and difficult to coordinate.

High levels of inventory often affect inspection as well. Usually, a contractor inspects 100 percent of all incoming material and the full lot of that material at one time. This procedure requires large inspection staffs and can result in backlogs. Frequently, a material shortage on the floor does not imply the need for vendor expediting, but rather the need for a push through incoming inspection. High inventory levels are partly the result of a war-reserve mentality that pervades the industry and partly the result of a company's growth from research organization to high-volume manufacturer.

Work-in-process inventory is a related and bigger problem. Most defense contractors do not formally follow the typical commercial process of receiving a finished subassembly into inventory and then issuing it out again on another manufacturing order; instead, they usually send completed work to holding areas or cribs. A notice then goes to accounting to report labor completions only; the company needs those reports in order to calculate earned value and to collect progress payments. The finished

When a scheduling problem or shortage occurs, management often shifts the focus of the work force from what needs to be built to what can be built. The outcome does not affect the company's revenue, but the firm may build years' supplies of some subassemblies and therein force component shortages on subassemblies needed in the near future. The sheer physical presence of the inventory is also detrimental to operations since it promotes loss of material and quality problems. The latter result from the need to retrofit in order to comply with engineering changes.

Engineers are constantly making changes to improve products, and in the process they create some very large problems for the manufacturing organization. The most obvious one is simply communicating these changes to the

this environment is the inability to schedule and reschedule during the manufacturing process. It underlies all the above problems and collides head-on with the main cultural obstacle to change: the program-versus-plant orientation to production.

Many defense contractors have a "contract only" or "program only" view of their manufacturing operations. This mind-set results in separate scheduling by program, separate stockrooms, separate work centers, and even separate control systems, all of which are a result of the customer's requirement to report status by contract. While effective, these separations are inefficient and redundant. The most obvious example is inventory control. The contractor maintains accounting segregation, and usually

What is manufacturing resource planning?

The concept of manufacturing resource planning was developed in the 1960s. In its earliest configuration (generally referred to as MRP-I), it was a computer technique known as material requirements planning. During the 1970s, it evolved into MRP-II, or manufacturing resource planning.

Manufacturing resource planning is based on the philosophy that efficient manufacturing results from clear and precise communication throughout the organization. This communication starts at the engineering stage, continues through production planning and material planning, and eventually involves the stockroom, shipping, and the receiving docks. Participants include clerical personnel as well as foremen, planners, and management at all levels.

Underlying the process is the principle that material availability (without excess) is the most important factor in on-time and efficient production. A user first creates a master schedule and then employs software to analyze the bills of material and determine the optimal production and vendor delivery schedules.

All software for manufacturing resource planning uses a common algorithm that analyzes each requirement for all parts (both assembled and purchased) and calculates supply schedules according to each part and each company's unique characteristics. The algorithm subtracts available inventory from gross material requirements to determine net requirements, which in turn allow the software to generate time-phased work orders and material requisitions.

A module for planning capacity requirements uses the routing file to determine how the work can be scheduled and loaded through the various functional departments of the shop. Each week the system replans, taking into account work accomplished and new work to be scheduled; it then provides follow-up information to control the execution of the material supply plan.

Included in the plan's execution is the scheduling and control of all associated activities, such as requisitioning, work order preparation, receiving, issuing, inspection, and rework. Because a central data base houses all planning and control activities, the users can access any information needed to complete these functions. And because the system maintains the interrelationships of the data, users can stay abreast of events occurring in other areas that affect their functions.

Manufacturing resource planning is often depicted as a closed-loop process (see the figure). It translates top management's strategic business goals into mar ettno otens. supports those plans with production plans, and then translates the production plans, by end item, into a detailed master schedule. The master schedule, in conjunction with information from engineering, inventory, and purchasing, provides the basis for calculating component delivery and production schedules. Capacity planning indicates whether the plant has the resources to meet the plan. Finally, workers execute the plan. The execution is monitored and the plan adjusted, if necessary, based on actual performance.

Manufacturing resource planning is a formal process which works only if a clear and timely communication network exists. Changes to the schedule, product, or process must be immediately communicated to avoid problems in execution. The process is most effective when used with on-line computer software running off a central data base. That software should assist in the execution and control of the entire process.

Defense contractors became interested in manufacturing resource planning following some recent advances in the software industry. Specifically, selected software now contains all traditional functions plus new ones designed for the defense industry. These new functions are as follows.

Configuration management serves as the standard bill-of-material module in manufacturing resource planning. The software includes the manufacturing bill of material

the contractor must account by contract for all direct and indirect labor and scrappage. This separation fosters competition for internal resources rather than a coordinated plan for using plant, material, and labor.

Just as operating practices vary by contract, so do the automated systems that support them. The systems environment in the defense industry is characterized by mainframe computers, large and highly technical staffs, and a variety of systems. Defense contractors automated most of the functional modules and submodules of their standard manufacturing control systems in the late '60s and early '70s, before a standard system existed. Unfortunately, these systems are usually not integrated, are batch processing systems, and have separate versions for each program or contract. In today's world, systems integration, which allows functional groups such as planners and workers to truly share common data or information, is the most effective means of communication in a large, dynamic environment.

These problems are serious and have long been a way of but are constrained from doing so by the customer's regulations. Although DoD Instruction 7000.2 and related regulations mandate many sound management practices, they also impose accounting requirements on the contractor that have forced many inefficiencies. While contractors have struggled with this dilemma for years, only now, when increased production volumes have heightened the problems, are they demanding solutions.

A solution

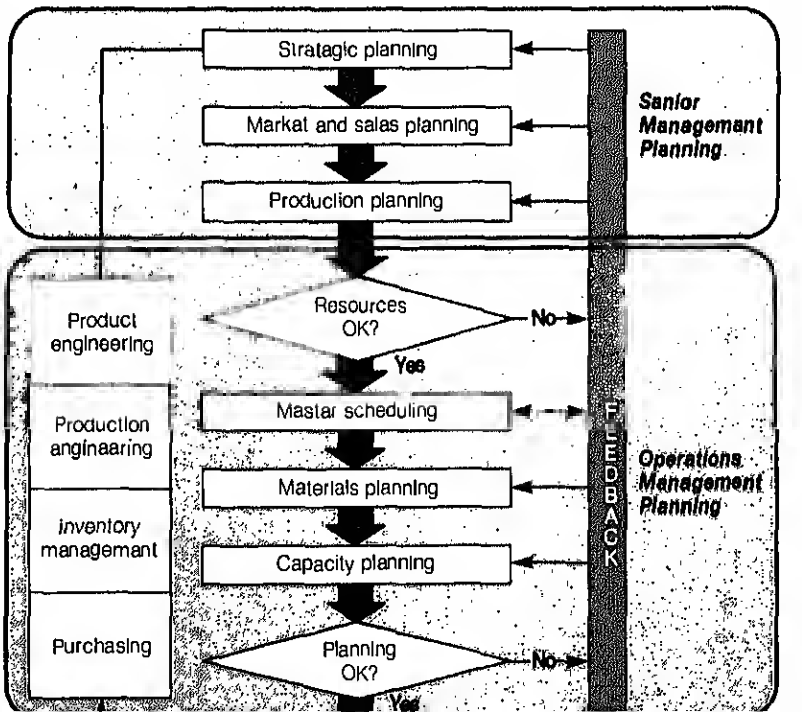
Many of the nation's defense contractors are discovering a commercial manufacturer's technique to improve manufacturing control called manufacturing resource planning (see the sidebar for specifics). If a company executes the process correctly, it can experience orders-of-magnitude operating improvements and reduce operating costs.

Manufacturing resource planning uses commercially available computer software to implement its philosophy of total systems integration and communication. The "defense" version can satisfy all Defense Department account-

and a separate design bill. Both have effectiveness controls which use a serial or model number to allow more than one production variant of the same part. The approach to effectiveness can vary by company and can include direct, and item, and block controls. The system also documents engineering change requests, notices, orders, and proposals. The software monitors all design changes and approvals and controls the preparation of design drawing packages.

Manufacturing planning and control includes the traditional inventory control, shop floor control, resource and capacity planning, and master scheduling modules of the standard system, all altered to incorporate contract control and other accounting requirements. The software tracks on-hand and on-order inventory by contract and segregates inventories either physically or on paper. If inventory is not physically segregated, the software can track borrowed material and then facilitate a payback. Most importantly, the system can plan production by contract and by lot size across contracts.

Cost-schedule control systems criteria



Interest in this tool for gaining competitive advantage is expanding rapidly. In 1980, only a handful of defense contractors were practicing manufacturing resource planning, but in September 1985, more than 600 persons representing 250 companies attended a seminar sponsored by the American Production and Inventory Control Society on the topic and its relationship to the defense industry.

For the defense contractor, manufacturing resource planning translates into a long list of benefits. Tangible benefits include reductions in work-in-process inventory, shortages and back orders, rework, storage, obsolescence, overtime, and manpower for support tasks. Perhaps the *most* tangible benefit is the quantifiable dollar savings associated with inventory reduction. Depending on the size of the company, the planning process can save millions of dollars with no loss in accountability.

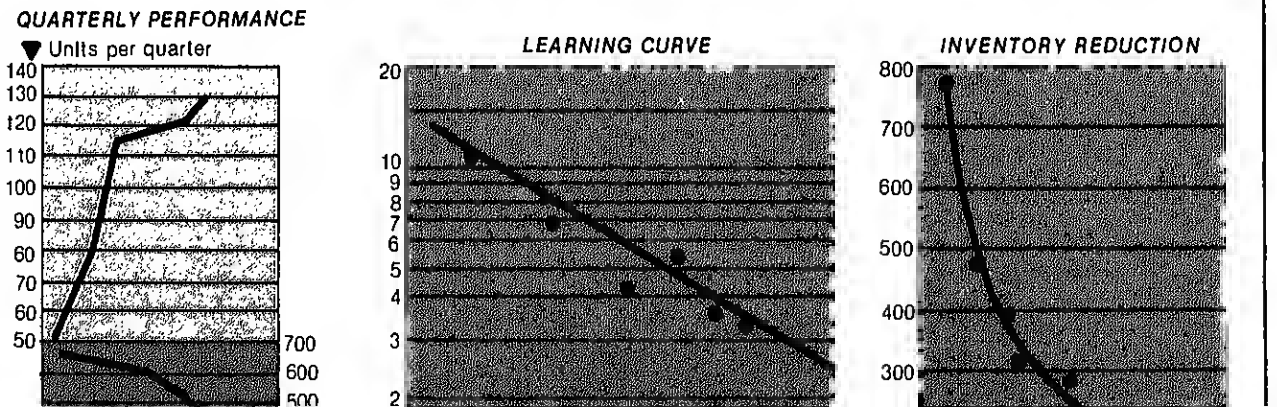
But the intangible benefits may be as important in their own right. Among them are:

- The ability to reschedule and do so automatically
- A better focus on the true problems involved in expediting and de-expediting
- The ability to communicate the company's true priorities to the vendor
- A dispatch capability
- Enhanced visibility of a facility's long-term capacity
- Faster operational response

Certainly the effort to improve operating practices and lower costs will impress the customer, whose representatives are usually on-site full time. Establishing a master scheduling function will improve communication, facilitate central plant planning, and aid in resolving schedule conflicts between programs. Integrating systems will result in more efficient data processing, both from the computer and from the support staff. Planning by contract, but lot-sizing across contracts, will allow the contractor to meet all production requirements while scheduling work with optimal balance and efficiency. Since the system rather than the user keeps track of contract allocations and accounting, a company can marry the operational efficiency of a commercial enterprise with the accounting system of a defense contractor.

Because manufacturing resource planning is so new to the industry, little actual data is available to illustrate defense contractors' experiences with the process. However, the information in the figure does represent actual data collected after one defense user had implemented manufacturing resource planning. The left chart in the figure shows the increase in units produced as manpower associated with production decreased. Much of this improvement was due to reduction in the support staff needed to manually

After implementing manufacturing resources planning, one defense contractor realized a major increase in productivity and significant reductions in manpower and inventory



Implementing the process

At least 40 contractors have installed or are installing manufacturing resource planning. The success of their efforts will depend heavily on three factors. First, top management must willingly support significant cultural changes in the organization. If those officials do not believe that manufacturing resource planning will provide the information necessary to run the plant and assure proper accounting, the company should not attempt to implement the process. Program managers must also have faith in the concept, especially in its potential for improving performance; they should not see it as a threat to their control or influence. In addition, managers must willingly give up the informal systems which they have created and which have served them well over the years.

The second factor critical to success is an adequate implementation team. It should include both users and management information system personnel who will be responsible for understanding the functional requirements, selecting and customizing the software, determining the exact uses for the software, and training the user community. An implementation project typically takes 18 to 24 months and could involve as many as 50 full-time team members. It is most likely to work if implemented on a pilot basis, one program at a time.

Finally, the support, and if necessary the permission, of the local Defense Contract Administration Service agency is essential. Installing manufacturing resource planning could imply radical operational changes such as commingling inventory, automatically borrowing and paying back inventory, and developing a new way to determine production schedules. Defense Contract Administration Service personnel must believe that the contractor has control over the materials, labor, and overhead charged on each contract, and they are more likely to do so if actively involved from the beginning of the project.

The Defense Department itself should take a broader role in encouraging these concepts industrywide. DoD regulations are currently interpreted differently from company to company. In part, these interpretations reflect differences in each company's internal controls, but they also speak to the need for further standardization of existing regulations.

In addition, industry needs new regulations that encourage those who are attempting to develop a standard solution for the industry. This direction would also address a significantly larger cost generator than touch labor.

DoD might also consider changing some of its financial incentives. Instead of awarding progress payments based only on actual progress, it might expand the formula to reward contractors who invest in and improve their production and inventory control systems and procedures.

Manufacturing resource planning can succeed in solving a defense contractor's manufacturing control problems only if these three fundamental changes occur. The company must change the way it plans and controls its manufacturing operations. The contractor must use computer software that is integrated, embodies the manufacturing resource planning philosophy, and is capable of contract accounting. And finally, the Department of Defense must actively encourage industrywide improvements in the production and inventory control function. The defense community has much at stake, and it stands to gain much as well. DMJ

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RICHARD GOLDEN is a manager in the Boston Office Consulting Division of Arthur Andersen & Co. He has implemented manufacturing resource planning in both commercial and defense organizations and has also developed contract-based manufacturing resource planning software. Mr. Golden earned a bachelor's degree in business administration from the University of Notre Dame and a master's degree in business administration from Boston University. He is certified in production and inventory management by the American Production and Inventory Control Society.

Making spares available for aging military equipment

By DONALD E. S. MERRITT

The Army may not be able to teach old dogs new tricks, but it has devised a way to breathe new life into old warhorses.

Providing timely, cost-effective spares support is an ongoing challenge for the military services. When the items being supported comprise an aging, dwindling fleet of aircraft, the task takes on even more formidable proportions. Replacement costs escalate. Lead times stretch. Readiness suffers.

Faced with just such a situation on its OH-6A Cayuse helicopter, the Army adopted a management approach known as commercialization. As the data presented below demonstrate, it has saved the service both money and time and enhanced readiness in the process. Spares managers may well want to consider applying the concept to other items of military hardware that have commercial equivalents. The following discussion will help them determine its relevance to their operations.

The world of hardware development and support is an ever changing one. Among consumer goods manufacturers, the most prevalent philosophy is "evolution not revolution," and in the military sphere, the Soviets have already mastered the art and science of growth without obsolescence. They have vigorously pursued preplanned product improvement, or P^3I, and seem to be more sensitive to husbanding scarce resources than we in the U.S. The Soviets lack a strong commercial consumer sector, however, a resource that the U.S. military can use to its advantage.

counterpart military equipment. The updating process retards obsolescence and at the same time affords increased readiness and sustainability because industry has already established a "hot" production base for the item. The importance of an up-and-running manufacturing base is clear in light of the nature of readiness.

As a defensive posture, readiness requires that equipment be operable and subsystems capable of performing their function. Hardware and software reliability contribute to this posture, as does the ease with which support personnel can maintain that hardware and software. They must be able to replace or repair it quickly. Both reliability and maintainability are functions of design; in other words, they are the components of inherent availability. Operational availability introduces the variables of manpower, facilities, equipment, and parts into the readiness equation. But in the absence of manufacturing facilities able to produce equipment and parts on demand, neither inherent nor operational availability is achievable.

Commercialization is an attempt to assure such availability. The services can apply the concept to military equipment such as the Army's OH-6A Cayuse, which has a commercial equivalent in the Hughes 500 helicopter series. In order to sustain the former, logistics managers take advantage of the spare parts production base already available for the latter. This approach also puts on the serv-

concept. As time and technology advance, these machines require constant updating in order to retain parity with their commercial counterparts in areas such as reliability, maintainability, and supportability. If parity or commonality is not maintained, more and more spare and repair parts migrate into the military-peculiar category. The original equipment manufacturer and his subvendors do not routinely stock such parts, as they do in the case of current design or configuration parts for commercial equipments.

This change in stockage status has far-reaching implications for the parts replenishment system in terms of lead times and cost, both of which begin to increase. In 1983, for example, a tail rotor control bracket assembly cost $38.98 and had a 12-month lead time; today, the same assembly costs $241 and requires a 15-month lead time. A spur gear costs only 93¢ more in 1985 than it did in 1983 ($43.19 versus $42.26), but the lead time needed to procure it has jumped from 3 months in 1983 to 13 months today.

What factors drive these increases? They have to do largely with forecasting and production scheduling. On commercial equipment, manufacturers gather data pertaining to failure rates and meantime-to-removal of components. They also know the total number of end items in use and thus can, with some degree of accuracy, forecast the number of spares and repair parts they will need each year. Given current enhancements to production techniques, they can also reasonably determine the flow of those numbers throughout the course of the year. With these predictions in hand, they can make or buy shelf stock to adequately and economically support their fielded equipmen

manufacture the original, now military-peculiar, part.

Aggravating the situation are the military's purchasing practices, which can be erratic. Sometimes they reflect a service's depot warehousing policies. The Army, for example, buys a number of items only once every five years or so and then buys in very large quantities. Because of funding constraints, a service may not purchase certain items at all in a given year. Whatever the reason, such practices make forecasting and production scheduling extremely difficult tasks.

Under such circumstances, commercial suppliers are understandably reluctant to commit capital to off-the-shelf stock for military-peculiar parts. The lack of definitive and timely data to properly forecast requirements drives up the cost of such stock. Nor are infrequent buys of diverse quantities conducive to cost-effective production scheduling. Businessmen normally channel unused capacity into profitable ventures; they disassemble and store or sell nonused machinery. In the absence of reliable forecasts of need that can be met through proper production scheduling, the capability and capacity to produce military-peculiar spares are almost nonexistent.

As a result, the services have no production base for many equipment parts and components. Manufacturers are not now producing similar commercial items that could provide an immediate source of increased support in the event of a surge. Without such a base, the services will not be able to sustain military equipment in the field for any length of time. Commercialization, as the Army demonstrated for a portion of its helicopter fleet, can do much to alleviate the stockage problem.

Often, parity between parts is not simply a matter of form, fit, and function; it may extend to content or manufacturing process as well. The vendor may or may not have the required material on hand and may or may not have retained the equipment and processes used to manufacture the original, now military-peculiar, part.

The OH-6A Cayuse helicopter, built by Hughes Heli-

Vietnam, the Army could draw upon a tremendous spares stockpile, but as the stockpile depleted, spare parts became increasingly difficult to obtain. During the late 1970s, the Guard continued to fly and maintain these helicopters in spite of a dwindling supply of spares and rumors of an eventual phaseout of the Cayuse during the middle 1980s.

Eventually, in October 1979, the chief of aviation logistics for the Department of the Army provided the following assessment of the OH-6A's status:

- It has no phaseout date and will be in use to the year 2000.
- It will remain in a mobilization status and will be deployable.
- It will remain type-classified "standard," defined by current Army regulations as "materiel determined to be acceptable for the mission intended, supportable in their intended environment, and acceptable for introduction into the Army inventory."

A joint working group composed of representatives from the National Guard Bureau, the Troop Support and Aviation Readiness Command (now the Aviation Systems Command), and Hughes Helicopters convened to discuss the future of the OH-6A program in September 1981. The group agreed that the Army should sustain the OH-6A as a first-line aircraft through the 1990s. In addition, it recommended that the service standardize all OH-6A helicopters and give them first-line capabilities comparable to the OH-58, which fills the Army's requirement for an observation helicopter.

In April 1982, responding to these recommendations, the deputy commander of the Troop Support and Aviation Readiness Command directed initiation of a program to use commercial repair parts on the OH-6A. This effort was to serve the dual function of modernizing the helicopter, while at the same time addressing the growing need for spare parts and providing a hot production base for surge requirements. The thrust of the commercialization effort at its inception was to replace Army-peculiar parts on the OH-6A with like parts available from the commercial equivalent. The latter had to be form, fit, and functionally interchangeable; offer quantifiable reliability, availability, or maintainability improvements; or be necessary in order to provide first-line capabilities.

As the hard commercialization program was getting facturer involved. In the case of the OH-6A, the Army proceeded as follows:

Working with class II engineering change proposals, spares managers first identified and then stocked in the Army spares program those commercial parts that are form, fit, and functionally interchangeable with military-peculiar spares. A class II engineering change involves either a change in documentation only—a correction of errors, for example, or the addition of clarifying notes—or a change in hardware—substituting an alternate material, for instance—which does not affect any factor listed in the definition of a class I change.

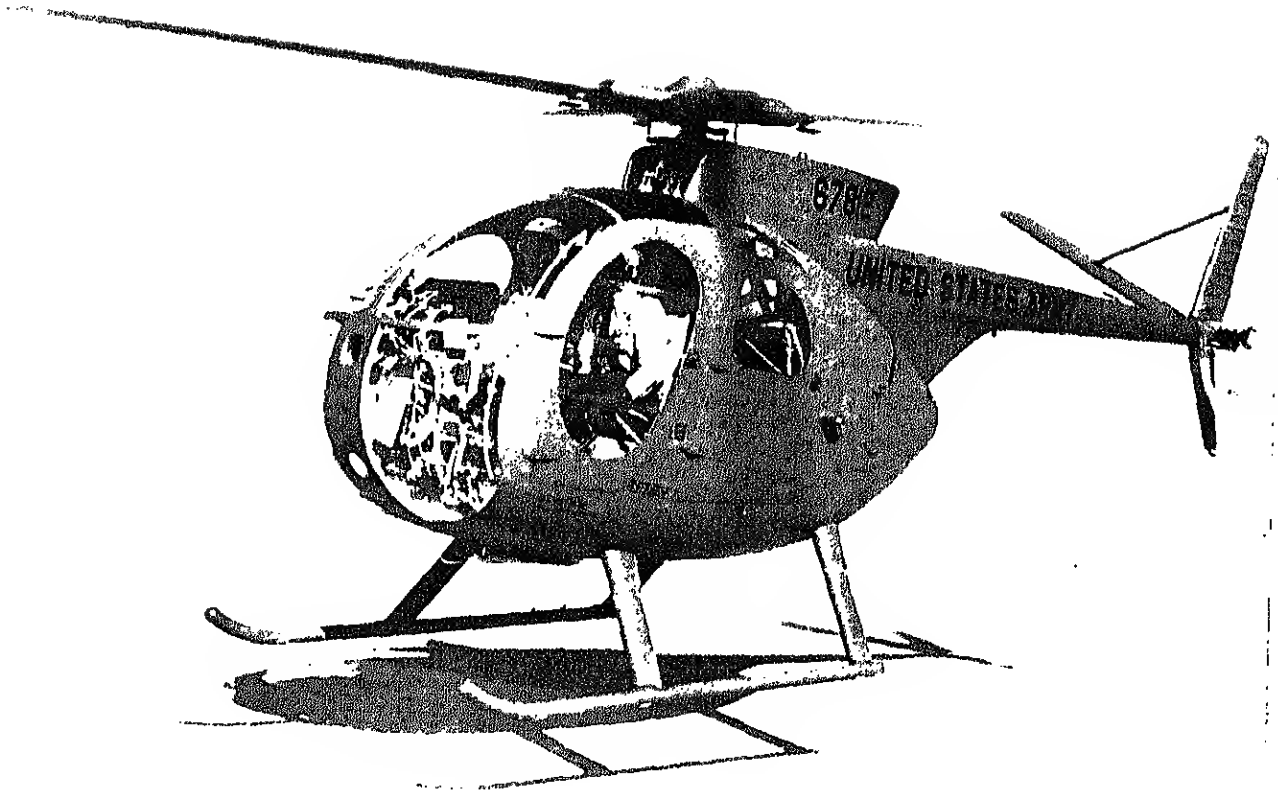
Using class I or class II changes, as appropriate, program personnel next identified and provisioned those parts that while not form, fit, and functionally interchangeable in their own right, would offer an increase in reliability, availability, or maintainability if replaced by one or two other parts. A class I engineering change affects one of the following:

- The functional or allocated configuration identification of an item.
- The product configuration identification (excluding referenced drawings) as contractually specified (or as applied to government activities).
- Any of a host of technical requirements that are contractually specified.

In carrying out the third step, Army managers consulted class I engineering changes again in order to identify and provision those parts that while not form, fit, and functionally interchangeable, did offer an increase in readiness because of their greater reliability and availability as a commercial spare.

Finally, commercialization program personnel maintained strict configuration control, documenting all changes made and the rationale for them. This process was vital to ensure that drawings were correctly annotated concerning part applicability to specific equipment end items.

Throughout the identification and provisioning process for the OH-6A, the configuration manager worked through the engineering change review board to assure configuration control. Composed of contractor and Army plant representative office personnel, the board had authority to approve engineering orders, classify engineering change proposals as either class I or class II, and approve both



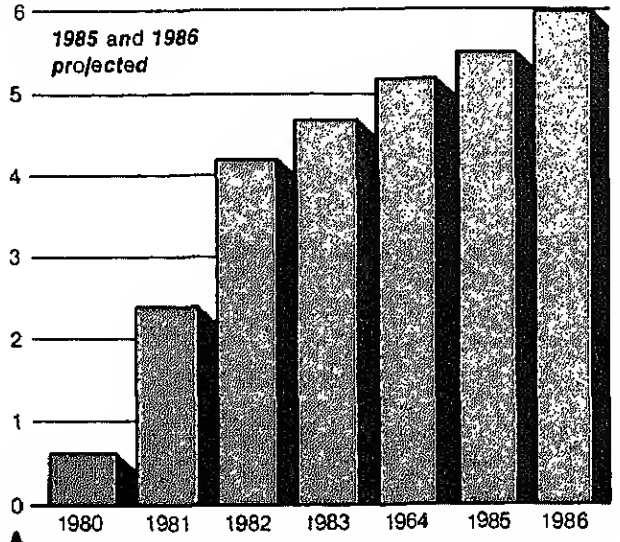
Commercialization took military-peculiar parts out of the Army's OH-6A and put commercial parts in while controlling the helicopter's configuration. The result: its readiness increased from 52 percent in April 1982 to 73 percent in March 1984.

U.S. ARMY PHOTO

tion control board. Approval at the appropriate level started the flow of documentation—drawing changes, revision of manuals, modification work orders, and provisioning data—necessary to implement the change.

there. To that end, the Army provided to contractors a demand history and projected consumption rate for the commercial parts incorporated. The commercialization concept, as currently being implemented, calls for such

Increased its OH-6A spares shipments from original equipment manufacturers



of OH-6A spares under the commercialization program

FORECAST SPARES COMMERCIALIZATION STUDY		Parts Analyzed
List 1	Existing commercial part	276
List 2	Class II engineering change proposal candidate	42
List 3	Class I engineering change proposal candidate	7
List 4	Unique OH-6A part	40

AIRFRAME COMMERCIALIZATION STUDY		Parts Analyzed
List 1	Existing commercial part	66
List 2	Class II engineering change proposal candidate	75
List 3	Class I engineering change proposal candidate	113
List 4	Unique OH-6A part	43

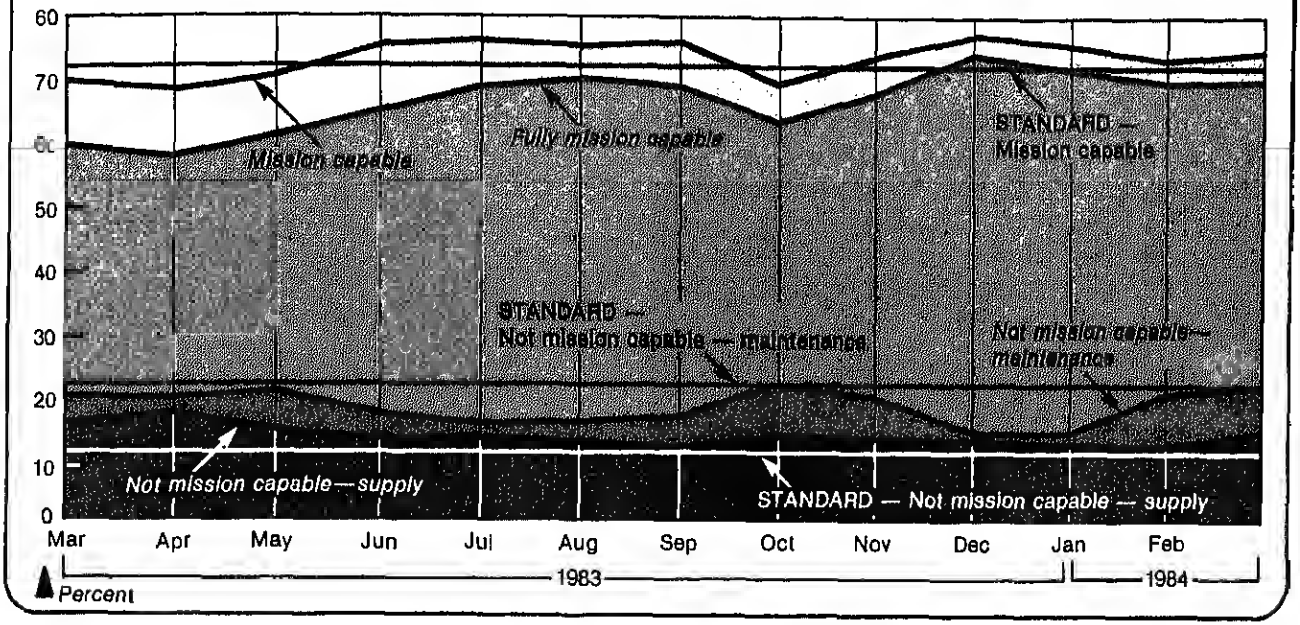
could no longer get the indicator it had been using, the service substituted the commercial version and soon found that replacement factors used in the supply data base were too high. Because of the poor reliability of the original indicator and the superior performance of the new instrument, the Army no longer needed the volume of replacements previously required.

The contractor secures several advantages from knowing the Army's projected demand for an incorporated commercial part. Visibility of Army spares requirements several years in advance is one. It allows a manufacturer to better program his raw materiel buys and his actual spares production. If he believes that the incorporated part will improve reliability, availability, or maintainability and thus reduce the quantity needed, he can reduce his production run accordingly. By combining the Army's factored requirements with his own projected commercial orders, the contractor can buy raw materials in larger, more economic lots, thereby reducing costs. He is also better able to plan the flow of work and the workload at his production facilities and thus achieve additional economies. The bottom line is a potential for lower per-spare costs to the Army. Following the switch from military to commercial main rotor method allows the government to place delivery orders with the contractor through a basic ordering agreement at the firm-fixed price in the price list, less a negotiated government discount. Using the same list and pricing arrangement, procurement personnel can also place purchase orders directly. The second option is to work with a negotiated price list for those commercial spares incorporated into the aircraft. The government can order from that list either through basic ordering agreements or straight purchase orders that are stand-alone, firm-fixed price contracts.

Even the most rigorous application of the above procedures will not eliminate all military-peculiar spares. Some parts will simply not have a commercial equivalent or substitute. To be sure, the number of truly military-peculiar spares is likely to be very small—the Army has identified only 83 on the OH-6A to date. Nonetheless, these items are necessary in order to fully sustain the overall system.

Under the commercialization concept, the federal government asks the contractor to support these requirements in the same way that he supports the other military and commercial spares requirements. To this end, the services furnish the same data on military-peculiar parts as they do

commercialization program



the commercial spares price list.

Since the inception of the commercialization program, the Army has steadily increased its spares shipments from original equipment manufacturers (see Figure 1). The service has expanded the role of commercial catalog pricing in its procurement efforts and has loaded cost and lead time data from the catalog into its provisioning master record for use in supply studies. Support rendered to the depot as a result of the OH-6A commercialization effort has effected a remarkable recovery in the facility's ability to service crash-damaged helicopters and those in need of maintenance.

Benefits from the OH-6A commercialization are many; they include:

- A cost-effective, time-saving switch to the Hughes commercial boom fairing section. The commercial boom needs only very slight modification for use on the OH-6A, costs less than $10,000, and requires just 100 man-hours to install from crate to aircraft. Previously, the depot was spending approximately $10,000 in parts and 400 man-hours to build the boom piece-by-piece. Use of the Hughes boom thus saves up to 6 months in downtime, a major

nel had to rebuild this component in order to replace it, a time-consuming and tedious task.

Of 9,000 OH-6A parts numbers reviewed under the auspices of the commercialization program, the Army determined that 5,500 were common already. It considered the remainder as candidates for commercialization and, to date, has analyzed 679 parts (see Figure 2). Readiness of the OH-6A, as measured by the Army, increased from 52 percent in April 1982 to 73 percent in March 1984 (see Figure 3).

The results from this unique process of providing spares support are clearly impressive. Commercialization has proven a cost-effective approach to improving readiness. It is an innovative concept that has breathed life and energy into the support structure for a fleet of aging helicopters no longer being produced. Moreover, the process has broad implications for other military systems with similar commercial counterparts. DMJ

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The Navy's watertight plan to reform shipyard training

By AMIEL T. SHARON

A training concept known as instructional systems development is helping Navy shipyard workers acquire skills that keep pace with the expanding technical demands of present-day ship repair and overhaul.

Employing some 70,000 civilian workers in eight geographically dispersed shipyards, the Navy is the nation's single largest employer of skilled tradesmen. In fact, the magnitude of the enterprise would qualify naval shipyards for a place among *Fortune* magazine's 25 largest American companies. The service therefore has a substantial stake in maintaining an effective apprentice training program. When a recent evaluation pointed to shortcomings in that program, Navy officials adopted an instructional systems development approach to revamp apprentice training.

In 1981, the Navy completed a survey which revealed a number of problems in the way the service was selecting and training its shipyard apprentices. For one thing, the civil-service selection process was enrolling an unacceptable number of applicants who, unable to cope with the attendant academic demands, had to be terminated from the apprentice program.

Moreover, the survey found that workers were performing some critical shipwork tasks incorrectly, resulting in costly rework and disruptions to overhaul and repair schedules. In one instance, improper welding of an aircraft carrier's boiler tubes necessitated rework costing $20 million and set back the overhaul schedule by four months. Another example, showed ship hull plates being riveted, even though welding had replaced riveting years earlier.

In addition, the Navy was spending more than $100 million annually to train shipyard workers yet had no systematic measure of training effectiveness. Nor were shipyards systematically exchanging expertise, and as a result, training for similar jobs differed from one shipyard to another. Finally, the survey revealed that shipyards were doing very little testing of practical skills and had developed no objective standards against which to evaluate on-the-job training.

The introduction of modern technology has significantly changed ship repair and overhaul. But craftsmanship—the ability to apply knowledge, tools, and materials to do a job correctly the first time—remains a key element in the industry. And the prerequisite to craftsmanship is proper training.

Beyond the problems highlighted by the 1981 survey, several recent developments in the ship repair industry underscore the importance of shipyard training. For instance, many individuals who have worked at the naval shipyards since World War II are retiring, leaving the facilities with a considerable number of relatively young, inexperienced employees. And the growing sophistication and complex-

systems, replacing nuclear reactor components on submarines, and fabricating ship components as small as a bolt and as large as a propeller.

Each job a craftsman performs is unique. Because many ship-maintenance skills are specialized and not available outside the shipyard, most workers must be trained from the bottom up within the yard. Generally, candidates must complete a four-year apprenticeship in order to acquire the skill and ingenuity needed for mastery of a single shipyard trade.

Apprenticeship training

An apprenticeship is a formal program of instruction set up to develop highly skilled workers, called journeymen, in a trade or craft. The Navy's program consists of both classroom and on-the-job instruction. The classroom curriculum includes subjects such as mathematics, science, English, and blueprint reading; it is similar for apprentices in all trades. Apprentices also receive classroom instruction in trade theory, which embraces principles and practices specific to a given craft. Experienced journeymen conduct the on-the-job training and help apprentices learn the practical tasks and duties of the trade.

Currently, more than 7,000 apprentices in some 50 different trades are receiving instruction at Navy shipyards. Trades they are learning include boilermaker, electrician, electronics mechanic, inside machinist, marine machinist, pipefitter, rigger, sheet metal mechanic, shipfitter, and welder.

Selection of qualified applicants for apprentice training is at least as important as the training itself. Trainees must possess certain aptitudes and abilities in order to benefit from instruction. Therefore, to improve the process for hiring apprentices, the Office of Personnel Management and the Department of the Navy jointly developed and validated a job-related selection examination.

In 1982, during the initial phase of the project, job analysts surveyed more than 4,900 skilled blue-collar civilian workers in 22 trades and crafts. They collected information about the importance and frequency of job duties and tasks, the use of tools and equipment, and various job-related factors. Using these data, a team of psychologists, working with a panel of subject-matter experts, identified 14 knowledges, skills, and abilities that are necessary for

Theresa Harring of Norfolk Naval Shipyard's Repairables Rework Center solders an electrical connection on a radar system.

pretested the battery on several thousand applicants at the Norfolk Naval Shipyard in April 1983. The results indicated that the test battery was a reliable instrument for distinguishing between good and bad prospects, and the eight Navy shipyards adopted the new examination in spring 1984. Analysts will track all apprentices hired under the new examination until 1987 to determine the examination's criterion-related validity. Evidence of that validity will take the form of correlations between selection-test scores and course grades, performance test scores, supervisory ratings, and attrition rates.

Selecting qualified apprentice applicants is the first step in the long process of turning inexperienced individuals into master craftsmen. The next step is teaching apprentices the skills of a trade.

program employs a training concept known as instructional systems development, a systematic method of designing, developing, and evaluating training that produces the needed skills at least cost.

In the past, techniques used to develop training programs have often reflected the whim and intuition of the developer and have not always ensured that the training would impart the required job knowledge and skills. Instructional systems development evolved from the mid-1950s conviction that a systems analysis approach could simplify and make more objective the complex task of developing effective programs of instruction. It eventually became a way to determine what trainees need to learn and to ensure they actually learn it.

In the wake of widespread agreement among training professionals that instructional systems development represents a good blueprint for analyzing, designing, and managing instruction, the military services and private industry have adopted the approach. The skilled-trades training program undertaken by the Naval Sea Systems Command, for instance, is patterned after a five-phase instructional systems development model:

Analysis. Program designers begin by gathering information about the characteristics of the learners and the material to be learned. Through task analysis they identify and then prepare learning objectives for each critical job task.

Design. During this phase, the program staff develops tests to measure the instructional objectives, selects instructional media, and sequences instructional events in the order the student will encounter them.

Development. Program personnel prepare instructional materials intended to meet the learning objectives.

Implementation. The staff specifies procedures to be used in scheduling, delivering, and monitoring instruction. Instructors and program managers receive essential training at this time.

Evaluation. Using tests, questionnaires, and other devices, analysts assess student learning and measure and maintain the program's efficacy and quality.

Task analysis

Determining what tasks shipyard workers must be trained to perform was the first step in bringing instruc-

injuries, the relevance of apprenticeship training, and the physical effort required for the job. The results of the analysis enabled instructional designers to identify the critical tasks—those that must be done right the first time—for each trade. Figure 2 presents a portion of the results from the task analysis for the pipefitter trade. Such data helped designers prepare the end product—a list of critical tasks that will be taught to the students.

By definition, a critical job task is one that is time-consuming, is performed by a substantial number of workers, and has serious consequences if not done correctly the first time. For example, analyzing a chrome-plating solution is a critical task for an electroplater, and fitting a body-bound bolt is critical for a marine machinist. Similarly, the tasks a shipwright performs in docking a submarine are critical.

Once designers have identified critical tasks, they must specify the instructional setting for each one. Some activities are best mastered on the job, while others are more efficiently learned in the classroom. Learning the geometry necessary to calculate the shape of three-dimensional objects is best done in the classroom; learning to operate the machine that fabricates metal in three-dimensional shapes is best accomplished on the shop floor.

Instructional designers can even eliminate some critical tasks from the curriculum altogether. Such tasks include those that are performed in many steps which, unless performed fairly often, are easily forgotten. Job-performance aids, such as decals attached to equipment or flowcharts which tell the worker what to do during each step of the procedure, can sometimes replace formalized training for these tasks.

To facilitate the shipyards' use of instructional systems development, education specialists guide and assist subject-matter experts at the yard in applying instructional technology to training development and design. Presently, each shipyard has at least one education specialist who works closely with two or more trade experts. In 1982, the Navy centralized its management and control of instruction in order to ensure that all shipyards provide uniform, cost-effective job training. Full-scale implementation of instructional systems development at the shipyards began in 1983.

Shipyards now no longer develop their own training

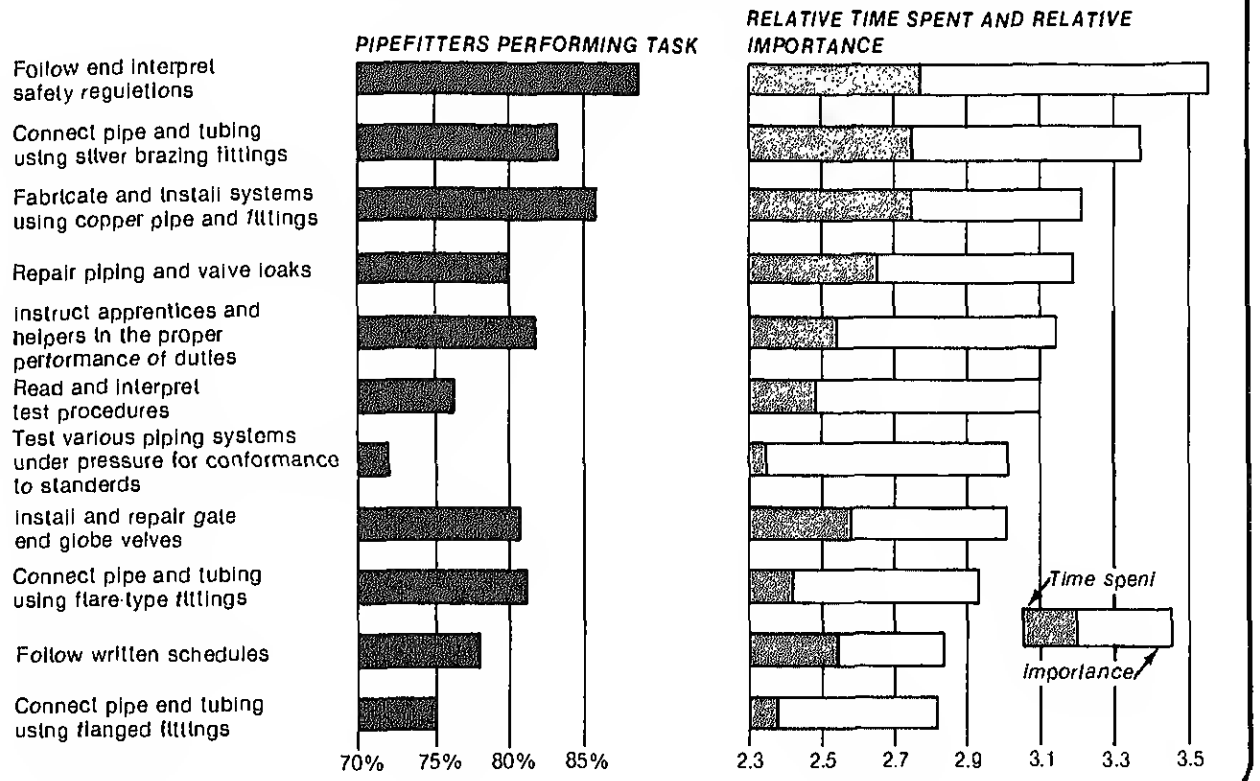
abilities required for skilled trades in a shipyard

Verbal abilities	• Understand the meanings of individual words • Read and understand sentences and paragraphs • Follow written directions • Follow verbal instructions • Remember details over a short period of time
Mathematical abilities	• Quickly and accurately do arithmetic • Compute or work with fractions and decimals • Structure or solve arithmetic word problems • Know basic algebra • Obtain information from a table of numbers quickly and accurately
Perceptual abilities	• Inspect objects to detect slight differences • Visualize a 2-dimensional form, having seen only the parts that make it up • Visualize a 3-dimensional object, having seen only a picture or drawing • Have good eye-hand coordination

worker, insulator, machinist (inside), machinist (outside), ordnance equipment mechanic, painter, pipefitter, rigger, sheet metal mechanic, shipfitter, shipwright, and welder. The packages consist of modules so that shipyards can easily adapt the training to differences in their respective workloads and facilities. For example, some yards specialize in submarine overhaul, others in surface craft.

Training packages are the major products of the instructional systems development process. They contain all the information and materials trainers and instructors need to teach shipyard workers a skilled trade. Included are student and instructor manuals and workbooks, mock-ups, and videotapes. Self-contained units of instruction that make up the packages allow the use of as many modules

Researchers asked 165 pipefitters to rate the relative importance of and amount of time spent on 11 specific tasks. A rating of 5 would indicate, respectively, a task considered of greatest importance or a task requiring very much above average time to perform.



of the training modernization program. Savings will result from the reduced number of hours apprentices and instructors must spend in the classroom and from the reduced time instructors will have to devote to course preparation. Even greater savings may be realized through the decreased need for rework. A lack of adequate measures of the costs associated with rework makes it difficult to estimate those savings; however, efforts are under way to make rework more visible so that the service can estimate cost savings in the future.

The collective mission of Navy shipyards is to serve the fleet by overhauling and repairing ships. Their fundamental objective is to complete all work on schedule, at a reasonable cost, and with quality workmanship. That work is must be able to trim metal to within one ten-thousandth of an inch, and they must be able to join metals by welds in which even the most powerful X-rays can find no flaws. Clearly, the technical demands of ship overhaul and repair have increased dramatically over the last decade. The Navy is therefore developing the special skills needed by its shipyard craftsmen through a program of instruction designed to keep pace with changing technology. PMJ

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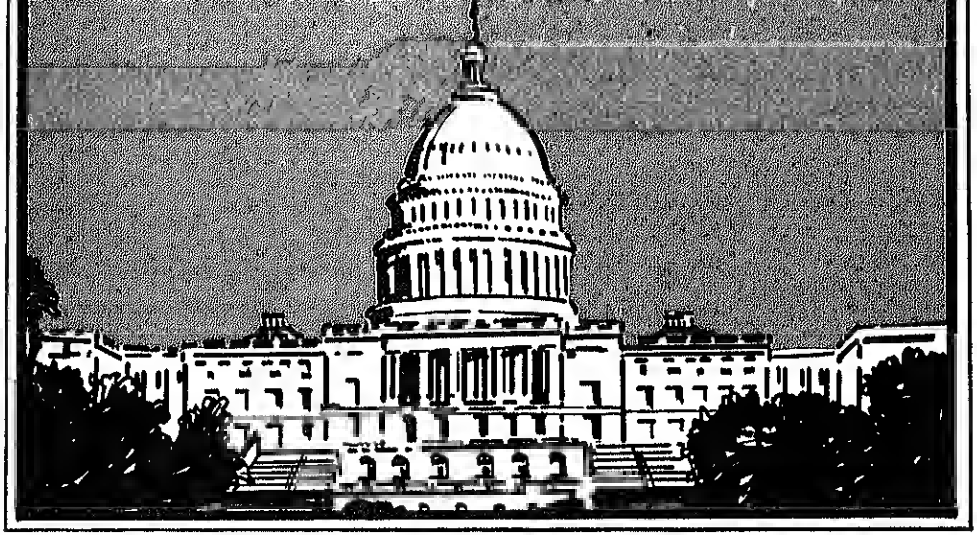

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Let's not oversell two-year defense budgets

By ORRIN G. HATCH

Biennial defense budgets will probably improve efficiency and effectiveness, but they will not necessarily mean an end to micromanagement or to instability in program funding.

The 1986 Defense Authorization bill contains a provision, sponsored by Georgia's Senator Sam Nunn, placing the Pentagon's authorization legislation on a biennial basis in fiscal year 1988.* If that amendment becomes law, what effect is it likely to have? Just how eagerly should supporters anticipate its passage? A review of the congressional budgeting process, in theory as well as practice, suggests grounds for cautious optimism, but enactment will probably not prove cause for general rejoicing.

Ten years of experience with another major reform, the Congressional Budget Act, should alert even the most ardent biennial budget advocate not to expect too much from a simple procedural change. Champions of that act billed it as a way to create order out of fiscal chaos on Capitol Hill, but we still suffer from a lack of fiscal discipline, late spending bills, and $200 billion deficits. Two-year budgets for the Defense Department will not solve all of the problems associated with the current annual cycle.

From DoD's perspective, the annual budgeting process requires an unreasonably large commitment of manpower to deal with budget, authorization, and appropriations committees in two houses of Congress. The department's staff now completes its work on the conference report of the Defense Appropriation Bill (or a continuing resolution) in December and immediately begins preparing to testify before the budget committees in February on the next year's budget. A two-year cycle for any or all of the budget, authorizing or appropriating phases, would reduce some of this burden.

The advantages of a two-year budget process vary depending upon the perspective of the observer, but among those most frequently mentioned are added stability in spending programs and improved oversight by Congress. The two-year budget might also eliminate the tendency to produce defense policy with a short-term focus. Now, broader policy issues receive insufficient attention as Congress concentrates instead on specific line-item account levels for the next fiscal year.

In addition, the biennial budget might help put an end to some of the duplication that results from annual authorization and appropriation bills. The House and Senate Armed Services Committees devote much effort to the approval of specific numbers of weapons each year, preceding the actions of the appropriations committees in the legislative process by only a few weeks. Surely a multiyear approval of procurement programs would spare time and effort, allowing the armed services committees to consider larger issues of general defense policy. Many in Congress agree

the detailed commitments of their predecessors.

The rationale for annual budgets

Periodic reauthorization for defense and certain other nondefense programs was fairly common before World War II. But the massive scale of the war effort forced Congress to employ permanent authorizations, and annual authorizations did not become fashionable again until the 1950s.

The late 1950s and early 1960s were a period of transition for the authorization and appropriation process. A major issue at the time was the creation of two separate air defense networks in the continental United States by the Army and the Air Force. Duplication in the construction of radar, storage, command, control, and launch facilities became the turning point in the development of annual authorizations. Senator Richard Russell, then the senior member of the Senate from Georgia, proposed requiring annual authorization of certain weapon systems in order to avoid such waste, and this measure eventually developed into a widespread requirement for annual authorization of appropriations in the budget process.

Members of Congress maintain that annual authorizations are an effort to exercise better oversight of executive agencies, and many members will admit that they feel a need to participate more fully in the appropriations process. Nevertheless, such explanations fail to account for the timing of these control initiatives as they have developed over the years. The overall size of the defense budget relative to the perceived need in peacetime was perhaps one factor that encouraged additional attention to program detail.

Moreover, to say that members of Congress want better oversight of executive agencies does not by itself explain their ability to launch additional control initiatives. The ability of Congress to pursue more aggressively its oversight responsibilities has perhaps more to do with the availability of additional resources. Specifically, the growth in the size of congressional staff has been a major factor in allowing committees, as well as individual members, to delve more deeply into issues, mechanics, and personnel in the Defense Department and in other executive-branch agencies too.

Between 1947 and 1983, total congressional staff (in-

portunities to hold hearings and write legislation on an annual basis, among other activities.

Despite the apparent advantages of biennial budgeting, the mere formality of reforming congressional procedures will not necessarily guarantee greater funding stability or more attention to major policy issues. Nor does it mean that Congress will avoid the intensive oversight of defense programs so often perceived by DoD officials as micromanagement. Ideally, statesmanlike leadership would serve to counteract pressures on members to micromanage, and, ideally, committees would settle their turf battles in a manner designed to produce good defense policy. But a biennial budget process itself would do little to alter existing incentives to get involved in program detail.

Assume for the moment that biennial authorization bills were standard procedure for defense programs. Several alternatives are available to those who would continue to dictate program detail. One obvious technique is the use of legislative language on appropriation bills. While technically this is an improper procedure under either House or Senate rules, it commonly occurs on almost every money bill. Even under the current annual authorization process, it is sometimes members of authorizing committees themselves who take advantage of appropriations bills to write additional legislation. Committees reporting two-year authorization bills could also write voluminous bills or reports that tie down specifics, two other options for becoming involved in detailed program management.

Micromanagement

As long as the incentive exists to specify detail, two-year authorizations would eventually disappoint their advocates, especially when a major advantage expected from the change is additional management flexibility. Ironically, supporters of biennial authorizations cite greater flexibility in reprogramming funds between activities as a partial solution to the problem of a changing defense environment over a longer authorization period. Yet Congress approved a two-year authorization experiment for the Nuclear Regulatory Commission only after reducing the limit on reprogramming of funds within the commission without committee approval. It did so in order to permit more congressional control.

country.

The prospect of being locked into specific spending levels for two years worries some DoD officials because Congress might decide to freeze the defense budget at the previous year's levels. But the real question is Congress's mood this year relative to next. It might easily vote in fiscal year 1987 to reduce appropriations levels in order to freeze outlays, an outcome that could make a two-year freeze in appropriations this year look attractive.

Biennial appropriations

Advocates of a two-year appropriation bill recognize that economic and political developments can alter priorities during the two-year period. However, they see the added funding stability countering those disadvantages, especially in view of the availability of supplemental appropriations to meet unforeseen contingencies. But my own observations lead me to believe that Congress would employ the "supplemental weapon" to destabilize program funding. For instance, legislators might choose to withhold certain funds in a regular appropriation bill in order to maintain additional leverage over specific DoD activities.

In reality, withholding funds in a regular appropriation bill is a more extreme measure than those traditionally used by the appropriations committees. More commonly, the committees simply add to appropriations bills legislative language limiting the use of these funds for certain purposes. Such language has a long history in both House and Senate money bills. Perhaps the best known limitation, found in many appropriation bills, is a provision which limits the use of federal funds for abortions. Congress might well employ such language more often in ways that would reduce the management flexibility sought by biennial budget advocates.

Legislators who wish to restrict DoD's activities can also include "tie-down" language in appropriations committee reports; such clauses clarify the committee's views or further instruct the executive branch on some issues. Of course, instructions of this nature, which involve report language rather than bill language, are binding only insofar as executive branch officials are unwilling to challenge the committees by ignoring the language. But the decision to ignore a committee's expressed wishes is a risky one for any official to make.

a basing mode for the system and passage by both Houses of a concurrent resolution approving the basing plan.

Perhaps the most frequent complaint about appropriation bills is the uncertainty associated with the lateness of their enactment, which often comes only after the beginning of the fiscal year and sometimes never. The continuing resolutions that replace late money bills shed little light on the final level of funding because these resolutions usually fund programs at last year's levels. While a biennial cycle might eliminate some uncertainty, delays would still develop. Why? Quite simply, they afford competing factions in the House or Senate the opportunity to hold bills hostage in an effort to pressure their opponents. Two years of funding in one bill might even raise the stakes and offer more incentive to play legislative "chicken" than currently exists.

A possible scenario

Despite these potential shortcomings, the advantages of a biennial budget outweigh the disadvantages. A biennial cycle would allow DoD and the Congress to devote more resources to review of longer-term policy issues and would thus make expenditure of taxpayers' defense dollars more efficient. In addition, Congress would be able to intensify its focus on major issues and would be better able to give general guidance under this system; the end result might well be a more effective defense for the nation.

While prospects for a complete shift to biennial budgets (appropriations as well as authorizations) may be dim, Congress might consider applying the concept in a more limited manner. For example, recognizing that some programs require more attention than others, legislators might retain annual budget authorizations only for such programs. Even now, despite the annual authorization and appropriation process, congressional committees do not scrutinize each item every year. Thus, as a first step, Congress and the defense community should seek to extend a two-year budget cycle to less controversial programs. This small, though important, procedural change would allow allocation of DoD resources away from oversight-related duties to more productive functional areas. DMJ

ORRIN G. HATCH, Republican of Utah, has been a member of the U.S. Senate since 1976. He chairs the La-

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The rationale for annual budgets

Periodic reauthorization for defense and certain other nondefense programs was fairly common before World War II. But the massive scale of the war effort forced Congress to employ permanent authorizations, and annual authorizations did not become fashionable again until the 1950s.

The late 1950s and early 1960s were a period of transition for the authorization and appropriation process. A major issue at the time was the creation of two separate air defense networks in the continental United States by the Army and the Air Force. Duplication in the construction of radar, storage, command, control, and launch facilities became the turning point in the development of annual authorizations. Senator Richard Russell, then the senior member of the Senate from Georgia, proposed requiring annual authorization of certain weapon systems in order to avoid such waste, and this measure eventually developed into a widespread requirement for annual authorization of appropriations in the budget process.

Members of Congress maintain that annual authorizations are an effort to exercise better oversight of executive agencies, and many members will admit that they feel a need to participate more fully in the appropriations process. Nevertheless, such explanations fail to account for the timing of these control initiatives as they have developed over the years. The overall size of the defense budget relative to the perceived need in peacetime was perhaps one factor that encouraged additional attention to program detail.

Moreover, to say that members of Congress want better oversight of executive agencies does not by itself explain their ability to launch additional control initiatives. The ability of Congress to pursue more aggressively its oversight responsibilities has perhaps more to do with the availability of additional resources. Specifically, the growth in the size of congressional staff has been a major factor in allowing committees, as well as individual members, to delve more deeply into issues, mechanics, and personnel in the Defense Department and in other executive-branch agencies too.

Between 1947 and 1983, total congressional staff (in-

portunities to hold hearings and write legislation on an annual basis, among other activities.

Despite the apparent advantages of biennial budgeting, the mere formality of reforming congressional procedures will not necessarily guarantee greater funding stability or more attention to major policy issues. Nor does it mean that Congress will avoid the intensive oversight of defense programs so often perceived by DoD officials as micromanagement. Ideally, statesmanlike leadership would serve to counteract pressures on members to micromanage, and, ideally, committees would settle their turf battles in a manner designed to produce good defense policy. But a biennial budget process itself would do little to alter existing incentives to get involved in program detail.

Assume for the moment that biennial authorization bills were standard procedure for defense programs. Several alternatives are available to those who would continue to dictate program detail. One obvious technique is the use of legislative language on appropriation bills. While technically this is an improper procedure under either House or Senate rules, it commonly occurs on almost every money bill. Even under the current annual authorization process, it is sometimes members of authorizing committees themselves who take advantage of appropriations bills to write additional legislation. Committees reporting two-year authorization bills could also write voluminous bills or reports that tie down specifics, two other options for becoming involved in detailed program management.

Micromanagement

As long as the incentive exists to specify detail, two-year authorizations would eventually disappoint their advocates, especially when a major advantage expected from the change is additional management flexibility. Ironically, supporters of biennial authorizations cite greater flexibility in reprogramming funds between activities as a partial solution to the problem of a changing defense environment over a longer authorization period. Yet Congress approved a two-year authorization experiment for the Nuclear Regulatory Commission only after reducing the limit on reprogramming of funds within the commission without committee approval. It did so in order to permit more congressional control.

country.

The prospect of being locked into specific spending levels for two years worries some DoD officials because Congress might decide to freeze the defense budget at the previous year's levels. But the *real* question is Congress's mood this year relative to next. It might easily vote in fiscal year 1987 to reduce appropriations levels in order to freeze outlays, an outcome that could make a two-year freeze in appropriations this year look attractive.

Biennial appropriations

Advocates of a two-year appropriation bill recognize that economic and political developments can alter priorities during the two-year period. However, they see the added funding stability countering those disadvantages, especially in view of the availability of supplemental appropriations to meet unforeseen contingencies. But my own observations lead me to believe that Congress would employ the "supplemental weapon" to destabilize program funding. For instance, legislators might choose to withhold certain funds in a regular appropriation bill in order to maintain additional leverage over specific DoD activities.

In reality, withholding funds in a regular appropriation bill is a more extreme measure than those traditionally used by the appropriations committees. More commonly, the committees simply add to appropriations bills legislative language limiting the use of these funds for certain purposes. Such language has a long history in both House and Senate money bills. Perhaps the best known limitation, found in many appropriation bills, is a provision which limits the use of federal funds for abortions. Congress might well employ such language more often in ways that would reduce the management flexibility sought by biennial budget advocates.

Legislators who wish to restrict DoD's activities can also include "tie-down" language in appropriations committee reports; such clauses clarify the committee's views or further instruct the executive branch on some issues. Of course, instructions of this nature, which involve report language rather than bill language, are binding only insofar as executive branch officials are unwilling to challenge the committees by ignoring the language. But the decision to ignore a committee's expressed wishes is a risky one for any official to make.

a basing mode for the system and passage by both Houses of a concurrent resolution approving the basing plan.

Perhaps the most frequent complaint about appropriation bills is the uncertainty associated with the lateness of their enactment, which often comes only after the beginning of the fiscal year and sometimes never. The continuing resolutions that replace late money bills shed little light on the final level of funding because these resolutions usually fund programs at last year's levels. While a biennial cycle might eliminate some uncertainty, delays would still develop. Why? Quite simply, they afford competing factions in the House or Senate the opportunity to hold bills hostage in an effort to pressure their opponents. Two years of funding in one bill might even raise the stakes and offer more incentive to play legislative "chicken" than currently exists.

A possible scenario

Despite these potential shortcomings, the advantages of a biennial budget outweigh the disadvantages. A biennial cycle would allow DoD and the Congress to devote more resources to review of longer-term policy issues and would thus make expenditure of taxpayers' defense dollars more efficient. In addition, Congress would be able to intensify its focus on major issues and would be better able to give general guidance under this system; the end result might well be a more effective defense for the nation.

While prospects for a complete shift to biennial budgets (appropriations as well as authorizations) may be dim, Congress might consider applying the concept in a more limited manner. For example, recognizing that some programs require more attention than others, legislators might retain annual budget authorizations only for such programs. Even now, despite the annual authorization and appropriation process, congressional committees do not scrutinize each item every year. Thus, as a first step, Congress and the defense community should seek to extend a two-year budget cycle to less controversial programs. This small, though important, procedural change would allow allocation of DoD resources away from oversight-related duties to more productive functional areas. DMJ

ORRIN G. HATCH, Republican of Utah, has been a member of the U.S. Senate since 1976. He chairs the La-

When you take the witness stand

By STEPHEN A. KLATSKY

Mr. Klatsky is the senior civilian personnel labor law counselor at the Army Materiel Command, Alexandria, VA.

As litigation in the civilian-personnel arena proliferates, it is increasingly likely that as a federal manager, you will be called on to testify at administrative or judicial proceedings, either as a nonparty witness or as a principal in a case. Regardless of the type of hearing or one's interest in it, a prospective witness should follow several general guidelines in order to enhance credibility and improve performance on the stand.

Preparation should begin as early as possible. You and the agency's advocate or counsel should compare notes and formulate a strategy for intelligibly and convincingly presenting your testimony. Ask the advocate to outline the procedural sequence in which the hearing will unfold, the key issues it will address, and the reason you have been called as a witness.

Play an active role. Don't be afraid to make suggestions to the agency advocate or to convey your concern about a particular point of contention or question. Tell the advocate all you know about the case. This will facilitate development of a complete and effective line of questioning.

To alleviate some of the nervousness and anxiety that naturally precede an appearance on the witness stand, visit the room or setting in which the hearing will occur. Quite often, it is neither as formal nor as intimidating as you expected. If such a preview is not possible, ask the agency advocate to describe the setting for you. Generally, witnesses who are familiar with the venue are calmer and tend to provide clearer, more incisive testimony.

Be prepared for cross examination. The demeanor on the stand are often as important as the substance of the testimony. In cases involving conflicting testimony, credibility and respectability can spell the difference. Look clean, neat, and professional. Leave your loud sport coat and flashy jewelry at home.

Your attitude should be as serious as your appearance. Don't attempt to be humorous or sarcastic. When the adversary's representative badgers you or disparages your testimony, resist the temptation to spar; do not become angry or indignant. Attempts to confuse and discredit a witness are standard tactics that the judge or hearing official will appropriately discount or disregard.

Make sure you fully understand a question before answering. If necessary, have it repeated or reworded. Give complete, yet concise responses, and do not volunteer more information than the question calls for. It's all right to estimate when responding, but make it known that your answer is just that—an approximation. Do not object to a question or ask whether you must answer. Your counsel will know when to intervene.

If you make an error or slip of the tongue, correct or clarify it immediately. And don't be reluctant to admit honestly that you don't know or don't remember something.

Although it is a good idea to gather your thoughts for responses in advance, do not memorize "canned" answers to expected questions. Not only is a momentary mental blank in such instances embarrassing, it can also undermine your credibility.

On occasion you may have to furnish an

If the substance of your testimony is abstruse, unwieldy, or otherwise too difficult to convey in words alone, do not hesitate to use charts, graphs, or other visual aids. Don't be reluctant to broach the possibility of doing so with the agency advocate.

DoD officials are sometimes asked to appear as expert witnesses to provide technical or scientific information. A product-assurance specialist may be called on to explain why a contractor's product does not meet specifications, for example, or an engineer may be asked to testify about a design error that has caused production delays. If you are tapped to be an expert witness, be prepared to substantiate your expertise in the subject area. You may want to refresh your memory concerning the dates of your academic degrees, the number of years you spent in jobs relevant to the subject, and the significance of and circumstances under which you received awards or special recognition. Expect your credentials and expertise to be challenged during cross-examination. But again, do not become defensive or piqued.

After a witness testifies, the adjudicatory official frequently issues special instructions forbidding the individual to discuss the case or the information he or she presented. Violation of this edict is a serious breech of standards that could jeopardize the case and, depending on the jurisdiction, could constitute a violation of law. Discussing testimony with or encouraging a scheduled witness to corroborate or contradict prior testimony is a particularly serious breach. In fact, individuals have been removed from the federal service for doing so.

As a federal manager, you have a duty to cooperate with agency officials and investigators. Refusal to cooperate or hostility at an agency hearing can lead to disciplinary action. Individuals whose testimony is needed for a judicial or federal administrative hearing can be subpoenaed, and failure to appear can result in civil or administrative penalties.

Response and reply

Dear Sir:

Stephen A. Klatsky's article "How much time for union business?", which appeared in the Third Quarter 1985 issue of the *Defense Management Journal*, addresses a very sensitive and controversial federal labor-management issue: management's interest that an employee devote time to job duties versus the union's interest that employees who represent it be afforded time to fulfill the union's representational responsibilities. In his column, Mr. Klatsky raises a number of points that need further clarification.

The Federal Service Labor-Management Relations Statute grants employees the right to form a labor organization to serve as their representative to management. A union which has been accorded exclusive recognition assumes an affirmative obligation to represent the employees of its bargaining unit in matters concerning the employees' terms and conditions of employment. To fulfill this obligation, unions generally seek to secure an array of resources, including entitlements to use official time to perform representational functions. The statute itself grants unions only a few direct forms of support; among them are access to certain data maintained by management, free payroll dues check off, and two discrete instances of employee entitlement to official time. The union must obtain other resources either internally within the union structure or from external sources—primarily from management—usually through collective bargaining or negotiation.

Mr. Klatsky's article seems to suggest that an employee who is a union official is *entitled* to time away from the job for representational duties. Actually, the statute confers entitlement to official time for only two activities: negotiation of a collective bargaining agreement and, as determined by the Federal Labor Relations Authority, participation in proceedings before that body. The union must obtain all other "entitlements" to official time from management

It is beyond the scope of this analysis to delve into the intricacies and nuances of the collective bargaining process, but clearly the distinction between absolute versus negotiated right to official time is a meaningful one; a negotiated right gives management much more leverage in the collective bargaining forum than the article might lead one to believe.

Mr. Klatsky also states that the only restriction on the use of official time for collective bargaining is that the number of employees granted such time cannot exceed the number of union representatives at the activity. Actually, 5 USC 7131(a) establishes that the number of employees entitled to official time in order to represent the union in collective bargaining is limited to the number of individuals that management places at its side of the bargaining table. The statute does not peg the number of employees so entitled to the number of union representatives at the activity.

Another assertion in the article is that case law "has resolved that union representatives may use official time to prepare financial reports that must be filed with the Department of Labor." In reality, the Federal Labor Relations Authority, in 2 FLRA No. 1, found that this activity is one for which the union can *propose* at the bargaining table that it be granted official time. In other words, union representatives have no inherent right to use official time in preparing financial or other reports required by the Department of Labor unless that right is secured through the collective bargaining process.

The article goes on to discuss various approaches for determining what constitutes a fair and equitable amount of official time for employees serving as union representatives. Specifically addressed are the reasonable time standard, the concept of a fixed percentage of total available official time, and the specified lump-sum arrangement. The author then makes the following statements:

tational purposes.

- The collective bargaining agreement should set forth the authority for management to collect and maintain data concerning a union official's use of official time.

Actually, the first two assertions are not absolutes. Both conditions may be negotiated—or not addressed at all—at the option of the parties at the bargaining table. The third, management's authority to collect and maintain records on official time usage, is not a proper subject for bargaining with the union (although procedural aspects and related arrangements may very well be negotiated). The Office of Personnel Management, in FPM Letter No. 711-161, requires management to keep such records.

Citing case law, the article also indicates that a supervisor can prohibit union officials from performing representational duties (and require instead that they do their jobs) only when the employee's failure to perform his government duties will have a "serious negative" impact on the agency's mission. Again, I believe this may overstate the matter. As noted above, an employee's entitlement to official time in order to perform representational duties for the union generally proceeds from what the parties agree to in negotiations. The terms of that agreement may very well limit the times and circumstances under which union representatives may use official time.

Similarly, while it is generally true, as Mr. Klatsky points out, that an employee enjoys reasonably broad protection from reprisal for using official time to serve as a union representative, the employee is not *always* and *completely* immune from corrective or other forms of restraining action on the part of management. The key, again, lies in the procedures, limits, and controls that the parties have established in their collective bargaining agreement. If the employee fails to adhere to the negotiated provisions, management has the right to initiate appropriate corrective measures.

Solutions to official-time questions will not

mate conclusion that "managers and union officials need to recognize each other's legitimate concerns and approach negotiations in a spirit of fairness, compromise, and pragmatism."

JOHN D. GREEN
Labor Relations Specialist
Headquarters, Defense Logistics Agency

Mr. Klatsky replies:

Mr. Green's exception to several assertions I made in a recent column stem from our different perceptions of the sophistication of post-Civil Service Reform Act federal labor unions. I believe federal unions have evolved beyond the embryonic stage and are quite capable of protecting the enhanced rights granted them by the 1978 reform statute.

It is true, as Mr. Green states, that the law concerning the use of official time for union representational duties is broad and allows the parties to fill in the blanks at the collective bargaining table, where, incidentally, *federal unions have proven a formidable* match for management. (As legal advisor to and member of various management negotiating teams, as reviewer of the Army Materiel Command's 150 bargaining agreements, and as management's advocate in mediation and impasse-resolution cases, I can say that unions are neither naive nor unprepared when they come to the table.)

If the law defines the union's representational obligation as extending to all employees of the bargaining unit, not just to dues-paying union members, then management should expect the unions to seek negotiation and to propose that official time be available for performing representational functions. Also, management should expect the mediation process to favor the union when management has objected to use of gain substantively. It should try to ensure that the contractual terms are clear, unambiguous, and reasonable and not attempt to restrict the union's use of official time for bona fide representational duties.

Mr. Green correctly observes that sources outside the local collective bargaining *environment cannot impose a solu*tion to the official-time issue. I did not intend to suggest otherwise. I meant only to proffer principles and to suggest that management should be willing to negotiate and be able to do so from strength. However, management should not deceive itself into believing that strength is synonymous with an unyielding resolve to deny union representatives official time for exercising their representational obligations.

Indeed, much of the union's entitlement to official time is a product of the collective bargaining process. True, the statute confers entitlement only for negotiation of the collective bargaining agreement and participation in proceedings before the Federal Labor Relations Authority; however, it would be naive to assume that union negotiators will not aggressively seek official time for those representational obligations recognized by *statute. Moreover, decisions* of the Federal Service Impasses Panel, which mediates and decides negotiation stalemates, indicate that management fights a losing battle when it attempts to significantly reduce the amount of official time provided for representational duties but has no sound factual record indicating that union officials have used excessive time and that agency work has suffered as a result.

As to the matter of filing reports required by the U.S. Department of Labor, I was not implying that unions have an *absolute* right to use official time for this purpose. However, federal courts have in fact rejected management's argument that filing these reports constitutes internal union business for which the union is not entitled to official time. Again, through the collective bargaining process, the unions seek the right lotted for representational duties may or may not be an issue during negotiations. In reality, though, the vast majority of contracts which specify the number of hours of official time available for representational activities explicitly exclude those hours devoted to collective bargaining. Certainly, *union negotiators are far too savvy to waive* their statutory right to unlimited official time for collective bargaining.

Despite repeated urging from the Office of the Comptroller General over the last nine years, management negotiators have frequently failed to incorporate recordkeeping provisions in bargaining agreements. Although FPM Letter No. 711-161 does direct management to maintain such records, the inclusion of a provision delineating this authority in the bargaining agreement is nonetheless advisable and reduces the prospect of union acrimony when management exercises that authority. Should the union object to the inclusion of such a provision, the impasse mediator, taking account of the FPM letter, will most likely favor management.

While management may indeed seek limits on the use of official time beyond those *established by the "serious negative" impact* criterion, it is really quite restricted in doing so. For all intents and purposes, a supervisor has the prerogative to deny a union representative official time only when the employee's absence will have a "serious negative" impact on the agency's mission.

I appreciate Mr. Green's comments and perspective. Certainly, the points he raises further underscore the importance of clarity, specificity, and thoroughness in collective bargaining contracts.

Witness (from p. 40)

tive hearings where the requested testimony subsequently could be used against you in a criminal action. Of course, you must testify if the authorities have granted

DoD audit initiatives reaping dividends

In its most recent semiannual report to Congress, the DoD Office of Inspector General summarized the department's investigations into fraud, waste, and mismanagement during the second half of fiscal year 1985.

Follow-ups on nearly 32,000 tips and recommendations from earlier reports resulted in savings of about $900 million, pushing two-year total savings from audit follow-ups to more then $4 billion. Ongoing corrective actions could add another $3 billion to the figure.

Various internal audits resulted in the issuance of 9,062 reports containing recommendations that could lead to monetary benefits of $1.1 billion. In the area of progress payments, for example, auditors found that although contractors were not reimbursed in excess of total actual expenditures, firms were receiving excessive periodic reimbursements, especially in light of present economic conditions. Forthcoming adjustments to progress payment rates will reduce DoD's annual interest costs by $230 million.

Internal audits also revealed that the computational model for determining requirements for certain war reserve material was inaccurate. This finding prompted officials to reduce or cancel scheduled buys totaling $135 million. The Army, according to its auditors, could reduce the cost of telephone service by $76 million if it bought rather then leased some equipment.

In the second half of FY 1965, the Defense Contract Audit Agency and the Army Corps of Engineers challenged $16.8 billion in preaward and postaward costs. Net savings from the more than 9,000 cases those activities closed during the period exceeded $5 billion. Significant results included cost avoidance of $23.6 million in unsubstantiated contractor claims and cost recoveries of $59 million in workmen's compensation overpayments and $4.8 million in spare parts overcharges.

DoD criminal investigative organizations opened 8,202 cases during the reporting period and closed 8,304 others. Completed investigations resulted in 502 convictions and indictments, bringing the two-year total to 1,646. These investigations also led to suspension or debarment of 346 contractors, a 47-percent increase over the first half of the year.

The most dramatic increase during the six-month period came in the area of fines, penalties, restitutions, and recoveries. The $88.6 million in recompense and retribution brought the year's total to $126 million, more than four times the total for all of FY 1984. The most common transgressions were overcharges, bribes, gratuities, product substitutions, false claims, bid rigging, and embezzlement. *(DoD Office of Inspector General semiannual report to the Congress: November 29, 1985)*

CHAMPUS recomputes resident-care fees

Officials of the Defense Department's Civilian Health and Medical Program of the Uniformed Services (CHAMPUS) have revised the rates paid to operators of psychiatric residential treatment centers for children and adolescents.

The reevaluation, carried out in response to recommendations by the General Accounting Office and the Defense Audit Service, is part of an effort to establish better control over daily fee rates at those facilities.

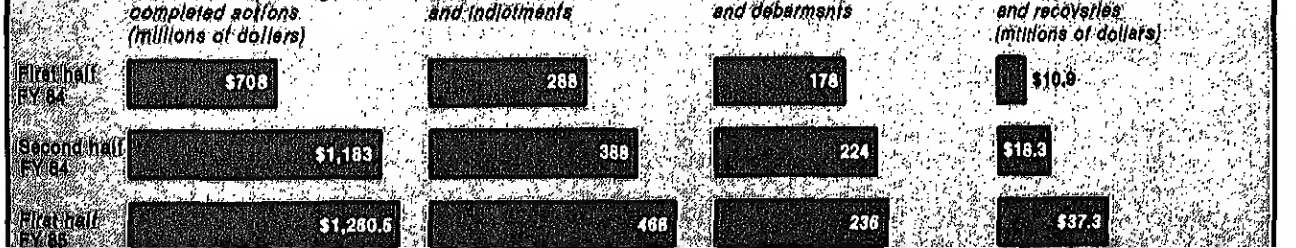
The refigured rates, which vary depending on the particular center, take into account non-CHAMPUS fee schedules and other data that program officials recently obtained from each participating residential treatment center. *(CHAMPUS news release: October 21, 1985)*

Air Force moves ahead with credit-card test

In an experiment that began in December 1985, the Air Force is issuing Diners Club credit cards to employees embarking on temporary duty trips. The one-year test program is in full swing for selected military and civilian personnel at Hanscom AFB, Massachusetts; Kirtland AFB, New Mexico; Wright-Patterson AFB, Ohio; Norton AFB and Los Angeles AFS, California; Air Force Audit Agency and Air Staff, Washington, DC; and Air Force Accounting and Finance Center, Colorado.

Under the agreement, the credit card company bills the individual, whom the government promptly reimburses.

Highlights of the Defense Department audit, inspection, and investigative activities



Use of the cards is intended to reduce the amount of cash that local finance offices must keep on hand for advance travel payments. So far, the most frequently voiced criticism of the approach is that it restricts government travelers to motels and restaurants that honor the card.

In a related trial program, the Air Force is issuing Diners Club traveler's checks to temporary-duty assignees at 11 activities. Service officials will decide in May 1986 whether to terminate or expand that practice. *(Air Force Times: November 18, 1985)*

Services eye realities of small-scale conflict

The Army and Air Force have teamed up to examine their collective ability to wage low-intensity conflicts and determine the best ways to ensure the availability of resources needed for supporting such military actions. The Navy is expected to join the effort within the year.

The services are conducting the self-analysis at the newly established Army-Air Force Center for Low Intensity Conflict at Langley AFB, Virginia. Low-intensity conflict embraces actions to bring about certain social, diplomatic, economic, or psychological ends. Frequently, its goal is to suppress terrorism or insurgency. Weapons, tactics, and doctrine differ from those used in large-scale engagements.

Upon identifying operational and resource deficiencies, ceploy approximately 14 Air Force, 11 Army, and five Navy and Marine Corps personnel. *(Army Times: December 9, 1985)*

Latest figures reflect upturn in reenlistments

The Army exceeded its fiscal year 1985 reenlistment objective of 73,000 by 0.6 percent, marking the first time since FY 1981 that the service met or exceeded its annual reenlistment goal. The figure was particularly heartening to manpower officials because the upswing came at a time of declining unemployment in the civilian sector.

Though retention news was good overall, the Army did fail to meet its reenlistment goal for career soldiers. The service made up the difference by exceeding its objective for first- and mid-term soldiers.

Of the Army's 73,428 reenlistments in FY 1985, 39 percent were first-term, 31 percent mid-term, and 30 percent career personnel. *(Army Times: November 25, 1985)*

National affairs expert heads women's panel

Jacquelyn K. Davis is this year's chairperson of the Defense Advisory Committee on Women in the Services (DACOWITS). In 1985, she served as the committee's vice chair.

Widely respected for her knowledge of national security issues, the noted author and and as foreign affairs editor of *Strategic Review*. She holds graduate degrees in international relations from the University of Pennsylvania.

Established in 1951 to advise the secretary of defense on matters relating to women in the military, DACOWITS comprises approximately 30 civilian members selected on the basis of academic, civic, and professional achievement.

Dr. Davis, a resident of Boston, succeeds Constance B. Newman in the non-salaried post. *(OASD(PA) news release: October 29, 1985)*

Navy to halt advance payment for tooling

Under a recent policy change, the Navy will no longer foot the bill in advance for the tooling contractors need to build weapon systems and military equipment. However, should they so choose, companies may pass the cost of tooling on to the Navy over time. The measure is part of a broader initiative to establish new guidelines for Navy acquisition.

In the past, the service paid a manufacturer up-front for the cost of purchasing and installing production equipment. This practice, according to officials, helped contractors achieve unreasonably high profit margins on military sales. A recent Navy study found that the profit rate for military transactions was four-and-a-half times greater than the profit rate for non-military ones.

Secreta of the Navy Jo n these costs if competition exists.

The Army and Air Force have not adopted the policy. *(New York Times: November 21, 1985)*

Army selects source for subscriber system

The Army has selected GTE Corporation as prime contractor for the service's Mobile Subscriber Equipment program.

Under the $4.3 billion contract, the Army will obtain 8,000 mobile radios, 1,400 switching centers, and 25,000 telephones. Upon full delivery, all Army units, both active and reserve, will have completely interoperable, encrypted, jam-resistant battlefield communications systems. The equipment will enable the Army, for the first time ever, to fully implement the command and control aspects of its airland battle doctrine.

The GTE mobile subscriber equipment incorporates key components of the French RITA mobile communications system. In addition to costing roughly $3.1 billion less than the competing British version, the GTE system fared far better in the technical evaluation phase.

The Mobile Subscriber Equipment Program represents a milestone in Army acquisition in that it featured a competitive nondevelopment approach that may result in savings of $500 million in research and development costs. Additionally, the selection of the GTE system promises to save the service abou 1.5 b l on n acquis ion

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Center for Applied Managament, USDA Graduate School, 600 Maryland Avenue, S.W., Room 108, Washington, DC 20004-2520

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Society of Aerospace Engineers Annual Congress, 400 Commonwealth Drive, Warrendale, PA 15096

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Technical Marketing Society of America, Dept. ASW, P.O. Box 3608, Torrance, CA 90510-3608

Joint ADPA/NSIA Meeting on Pacific Fleet Antisubmarine Warfare Activities (SECRET)
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CONTACT: (703) 553-8287 (ADPA Members) (202) 393-3620 (NSIA Members)
Mr. Gus Duke, Vitro Laboratories, 2361 Jefferson Davis Hwy., Arlington, VA 22202

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National Security Industrial Association, 1015 15th Street, N.W., Suite 901, Washington, DC 20005

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CONTACT: (201) 544-2112 or AUTOVON 995-2761
Director, CENTACS, ATTN: AMSEL-TCS-ED, Ft. Monmouth, NJ 07703-5204

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CONTACT: (202) 632-5600
U.S. Office of Personnel Management, Training Nominations, WATDS, P.O. Box 7230, Washington, DC 20044

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Apr 14-17 San Francisco, CA

CONTACT: (301) 434-1990
Robotics and Automation, c/o H. Hayman, 738 Whitaker Terrace, Silver Spring, MD 20901

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CONTACT: (401) 274-0801
The Institute of Management Sciences, 290 Westminster Street, Providence, RI 02903